GULF CANADA LIMITED

RESEARCH AND DEVELOPMENT DEPARTMENT
SHERIDAN PARK, ONTARIO, CANADA

THE BENEFICIATION OF LOW RANK CANADIAN COALS WITH HEAVY RESIDUA

- PHASE I -

Final Report

December, 1984

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EXECUTIVE SUMMARY

In 1983, Gulf Canada, together with Energy Mines and Resources Canada (CANMET) initiated a program to investigate the process by studying the behaviour of the various parameters which would have an impact on the quality of the final product. This work essentially represents the first phase in the development of a commercial process based on this technique.

The major conclusions which can be drawn from the results of this first phase are summarized below:

1. All low rank coals (1/2" to 16 mesh) can be upgraded in calorific value using this technique. High moisture coals show significantly higher increase in calorific value than low moisture coals. The tendency for spontaneous combustion is substantially reduced and dusting problems are essentially solved.

2. Coal quality, coal particle size, residuum quality and processing conditions have all been shown to have an impact on product yields and quality. In commercial ventures, therefore, it will be necessary to determine the optimum operating mode for each specific application.

3. The results are promising and the development of the process should be pursued by studies on a continuous unit. Other coals should be examined and the particle size range extended to larger coal samples (up to 1 1/2").

JUSTIFICATION

Low rank Canadian coals (subbituminous coal and lignite) represent greater than 70% of Canada's coal resources. They are largely surface mineable and located in various regions with good infrastructure. Low rank coals, however, are not competitive in thermal coal export markets due to their quality and handling characteristics, which result in low heating values and a tendency for spontaneous combustion.

Thermal coals are purchased for their energy content. The large moisture and oxygen content of low rank coals gives them their low heating values. A low heating value for a coal incurs a large shipping cost per unit energy. For low rank Canadian coals this more than offsets the cost advantage obtained in producing the raw coal.

At present, there is no suitable beneficiation process devised to eliminate moisture and oxygen content from low rank coals.

Gulf Canada conceived and patented a technique for upgrading low rank coals using low value petroleum residua. The method is based on the immersion of coal in hot residua causing a reduction in both water and organic oxygen content of the coal as well as modifying its surface properties. In this procedure not only is a low rank coal upgraded, but a good use has been found for low-value residua.

PROCESS DESCRIPTION

The process developed by Gulf Canada is similar in concept to immersion carbonization. The objective of both approaches is to eliminate water from the coals and at the same time reduce the pore volume, thereby inhibiting moisture readsorption.

The immersion carbonization technique uses hot oil at or above the decomposition temperature of the coal to allow pyrolytic material generated from the coal to plug the coal pores. The Gulf process is operated at below the decomposition temperature of coal, but at a sufficiently high temperature to drive out the moisture and maintain a reasonably fluid residuum for immersion.

In the Gulf process, therefore, low rank coals are immersed for a given period of time in a hot petroleum residuum. Moisture and some labile oxygen are driven out from the coals and their calorific value therefore increased. The calorific value of the coal is further increased by surface coating and internal adsorption of the residuum. The residuum protects the coal product from moisture readsorption and therefore greatly reduces the tendency of the coal to spontaneous combustion. The handling properties of the coal are also enhanced by the protective residuum layer. There should be no need therefore to spray this coal product.

Residua derived from the heavy oils and bitumen found in large quantities in Alberta are particularly suitable for use in this process. Upgrading processes based on hydrogen addition produce pitches, rather than solid coke, from heavy oils. This type of pitch has the high softening point and low penetrations demanded by the process. They are low cost. In the long term it is expected that future heavy oil and bitumen upgrading processes will make larger quantities of low value residua available in Alberta close to the coal deposits.

PHASE I PROGRAM

1. OVERVIEW

The program essentially consisted of a detailed experimental evaluation of the effect of different operating parameters on product yield and quality. In addition, a brief paper study of different options for pilot planting this process was made; also a cursory look at some preliminary economics.

The experimental work was done in a batch system. The parameters studied were:

a) Coal, five samples	Wabumun Poplar River Wapiti Coal Valley Roselyn
b) Coal size, three sizes	1/2" x 3/8" 3/8" x 1/4" 1/4" x 16 mesh
c) Residua, three types	DRB residuum (Donor Refined Bitumen Process) Montreal Decarb Edmonton VTB (treated)
d) Temperature, three	between 240°C and 320°C
e) Residence time, three	10, 20 and 30 minutes

Two hundred and four runs were carried out to evaluate the effect of these variables on product yield and quality. Prior to these runs, however, an additional thirty-four runs were made to optimize the experimental procedure to be adopted.

Mass balances were carried out to establish the solid product, gas and water yields. A selected number of gases were analyzed to determine their composition. The solid products were analyzed for calorific value and residuum content. Proximate analysis was also carried out on all solid products and ultimate analysis on a selected number.

Both the products and raw coals were subjected to a characterization program to evaluate their handling characteristics. Equilibrium moisture, porosity, tendency for spontaneous combustion and moisture uptake were assessed.

2. RESULTS

2.1 Effect of Variables on Yields

2.1.1 Water

In all cases virtually all the moisture present in the original coal samples was recovered as water.

2.1.2 Gas

Gas yield remained essentially constant under all the conditions studied. The yield (about 2 litres) represents less than 1% wt. of the coal feed. The gas composition was mainly carbon dioxide and methane with varying amounts of carbon monoxide.

2.1.3 Solid Product Yield

Actual product yields ranged between 85 and 100 mass percent based on coal feed. However, in order to determine the significance of product yield, the loss of water and amount of residuum picked up by the coal product have to be corrected for. When this has been done the product yields for Wabumun and Poplar River coals were in the range 95-97 percent, but Wapiti, Roselyn and Coal Valley were 93-94 percent. Since about 1 percent is lost as gas, the mass balance shows 2-4 percent unaccounted for in the case of the former coals and 5-6 percent in the latter.

The material unaccounted for could either result from degradation of coal particles so that they become fine enough to penetrate the wire mesh container (less than 28 mesh) and therefore become suspended in the residuum, or are coal liquid products which then mix intimately into the residuum.

Either way, the results indicate that under the conditions used in this program, low moisture coals such as Wapiti, Coal Valley and Roselyn show more materials unaccounted for than high moisture coals such as Wabumun and Poplar River. Less severe conditions might therefore be more appropriate for low moisture coals.

Also, as might be expected, there is an indication that the fine particle size coals are subject to more degradation than the larger sizes under the same conditions.

In a continuous operation, equilibrium conditions would be established whereby the degraded material would either be redeposited on the coal product or be lost as vapour (gas).

2.2 Effect of Variables on Product Quality

2.2.1 Residuum Content

The residuum content of the products depends significantly on particle size; i.e. the residuum content increases as particle size decreases. This is likely due to the increased surface area available per unit weight in the smaller size particles. Another interesting effect is the apparent relationship between residuum level in the product and the original moisture content of high moisture coals. This suggests that a mechanism in this process is replacement, at least in part, of the water by residuum in the pores of the coal.

An additional factor, not investigated in any detail in this program, relating to residuum level is the draining conditions given to the product. Undoubtedly temperature and time of draining after immersion are important. In this program, draining time was fixed, but the temperature varied to some extent with the temperature of immersion. Under these conditions, the softening point of the residuum is important. High softening point residuum drained more slowly and therefore left higher levels on the coal product. It should be noted that the draining conditions in a continuous unit would be different from that of a batch system and the results obtained in this program may be of limited value for scale-up.

Temperature and residence time of immersion, however, do not appear to affect the residua content of the products.

Apart from the obvious economic implications, the residuum level of the product also has a direct impact on the level of impurities which stem from the residuum e.g. sulphur, metals (ash content) etc. The residuum level also has a positive effect on volatile matter content. Therefore, those factors which influence residuum level, also influence a number of related factors.

2.2.2 Proximate Analysis

2.2.2.1 Water

As indicated earlier, all products were essentially water free, and independent of any variables in the ranges studied.

2.2.2.2 Ash

The ash content of the products was dependent on the water removed from the coal and residuum addition. Coal quality, coal particle size and residua quality therefore all affected ash content. Generally, however, a slight increase in ash content was observed.

2.2.2.3 Volatile Matter

Increase in volatile matter may help to lower the ignition and combustion temperatures of already active low rank coals. In this sense an increase in volatile matter content is beneficial.

The products from high moisture coals such as Wabumun and Poplar River showed significantly higher volatile matter content than the original coals. For low moisture coals, only moderate or no increase was observed.

It appears that the higher level of decomposition or degradation in low moisture coals is associated with the loss of volatiles. Coal quality and residuum content of the product therefore have significant effect on volatile matter content, and consequently coal particle size is also important. Residuum quality, temperature and residence time of immersion are relatively unimportant.

2.2.3 Sulphur Content

Sulphur content of the products depends on the sulphur level of the original coal, sulphur level in the residuum, and residuum content. Coal quality, coal particle size and residuum quality are therefore all important.

Fortunately low rank coals are generally low in sulphur, therefore except where residuum content of the product is high and a high sulphur residuum is used, the sulphur specification for thermal coals can be met. In the latter case, optimization of the process variables to minimize residuum content will be required.

2.2.4 Calorific Value

All products showed increases in calorific value over their parent coals. These increases are due almost totally to water removal and residuum deposition. The largest increases were therefore shown by the high moisture coals i.e. 40-50% for lignite, 20-30% for Wabumun subbituminous coal and 10% or less for Wapiti, Roselyn and Coal Valley coals.

2.3 Changes in product Characterization

The results from product characterization were all consistant with a decrease in pore volume in the products relative to the parent coals of 50-60%. This reduction in pore volume results in lower equilibrium moisture levels (44-80% reduction), a reduced tendency for spontaneous combustion (5-6°C temperature increase vs. 20°C) and lower moisture pick-up ratio. Actual measurement of pore volume by a mercury in-house method confirmed the lower pore volumes and also showed that the mean pore diameters of the products were considerably smaller than those of their parent coals.

Techniques for reducing pore volume even further should be investigated. A continuous operation may lead to more effective penetration and coating of the coal particles by residuum. In a batch operation there was no indication that changes in operating conditions would achieve higher pore volume reduction, although reprocessing the product could be effective.

2.4 Pilot Plant Designs

Two alternative designs for a 1/2 tonne per day pilot plant were developed on a preliminary basis. Approximate cost for the basic equipment was calculated at $50,000.

2.5 Economics

A preliminary review of the economics of a 500 tonnes/hour commercial plant indicates capital costs of the order of \$20-\$30 million and an operating cost of about \$1.90/tonne. These figures are based on batch data only, and because of the limitations the accuracy of the range in capital costs is ±50%. These are not considered large costs in view of the improved calorific value and handling characteristics of the coal. A more detailed and accurate estimate of the economics will only be possible after the process has been demonstrated in a continuous mode. However, indications are that the viability of the process will only be determined by studying each case on an individual basis.

CONCLUSIONS

1. All the coals studied in this program were upgraded in calorific value using this beneficiation method.
2. Virtually all the moisture present in the original coal samples was removed and gas production was constant at about 1% wt of the coal feed.
3. High moisture coals show significantly higher increase in calorific value than low moisture coals. More work needs to be done to optimize processing conditions for low moisture coals.
4. Product yields and quality were particularly dependent on coal quality, coal particle size and residuum quality. Temperature and residence time of immersion were less important.
5. Pore volumes in the products were 50-60% lower than in the parent coals. Lower equilibrium moisture levels and moisture pick-up rates were achieved, together with a reduced tendency for spontaneous combustion. These factors and the residuum coating give the products superior handling characteristics.

RECOMMENDATIONS

1. Development of the process should be pursued by studies on a continuous processing unit.
2. The particle size range for coals to be studied should be extended to coal samples up to 1 1/2 inches.
3. The processing conditions for draining the residuum from the product should be studied to optimize the residuum level of the product.
4. Techniques to further reduce pore volumes should be sought.
5. More basic studies should be done on low moisture coals.

TASK REPORT #1 - ACQUISITION OF COAL AND HEAVY RESIDUA SAMPLES

1. INTRODUCTION

This task covers the acquisition of coal and heavy residua samples for this research program. It also covers the treatment of residua samples necessary to make them suitable as immersion media.

2. ACQUISITION OF COAL SAMPLES

Gulf Canada employees witnessed the acquisition of all the coal samples for this research program. These samples were first shipped from site to Birtley Coal & Minerals Testing in Calgary for analysis. They were then shipped to Sheridan Park. The specifics of these coal samples are listed in Table 1-1.

TABLE 1-1 SPECIFICS OF COAL SAMPLES USED IN RESEARCH PROGRAM

Coal Sample	Seam/Mine	Rank	Location	Operator	Sampling Location	Quantity Obtained (kg)
Wabumun	Highvale	Subb. B	Highvale Mine (Wabumun) Alberta	Transalta	Directly from Seam	355
Roselyn	Montgomery	Subb. C	Roselyn Mine (Sheerness) Alberta	Manalta	'Nut' and 'Stoker' Chutes at Tipple	294
Wapiti	—	Bituminous	North East British Columbia	Gulf Canada Resources Inc.	Exploration Adit	389
Poplar River	Hart	Lignite	Poplar River Mine Saskatchewan	Sask. Power Corp.	Raw Coal Crusher House	325
Coal Valley	Mixed Seams	Bituminous C	Coal Valley Mine Alberta	Luscar Sterco	Clean Coal Stockpile	161

3. ACQUISITION OF HEAVY RESIDUA SAMPLES

Four different types of heavy residua samples were obtained from Gulf Canada's refinery system. The specifics of these samples are listed in Table 1-2.

TABLE 1-2 RESIDUA SAMPLES USED IN RESEARCH PROGRAM

Heavy Residua Samples	Type	Source	Quantity (Gallons)	Treatment Required for Coal Beneficiation
210M Asphalt	Asphaltic Crude	Clarkson Refinery	10	None
Decarb Asphalt	Asphaltic Crude	Montreal Refinery	10	None
DRB Residuum	Pelican Lake Heavy Oil	DRB (Donor Refined Bitumen) Pilot Plant at Gulf R&D	5	Vacuum Distillation to obtain 535°C+ material
Vacuum Tower Bottoms	Conventional Crude	Edmonton Refinery	20	Thermal Treatment

4. PREPARATION OF HEAVY RESIDUA SAMPLES

For this study, softening point was used as the single criterion to determine whether residua preparation was necessary. A minimum softening point of 85°C was set. The two heavy residua samples from asphaltic crudes (210M Asphalt and Decarb Asphalt) did not require any treatment for coal beneficiation. The DRB residuum was obtained from DRB products by vacuum distillation (the 535°C+ cut). This material did not require any further treatment. The vacuum tower bottoms from Edmonton Refinery, however, was too low in softening point to be used as beneficiation medium. Thermal treatment followed by fractionation was used to obtain higher softening point material.

4.1 Autoclave Study to Determine Thermal Treatment Conditions

To establish the conditions for thermal treatment of Edmonton vacuum tower bottoms (VTB), a one-litre autoclave (Autoclave Engineers) was used for the experiments. Temperature studied in this work ranged from 400°C to 420°C, with a common residence time of 60 minutes. Pressure profiles were monitored during the experiments.

The contents in the autoclave after thermal treatment were decanted into a flask and distilled according to ASTM Method D1160. The 504°C+ fractions were isolated and their softening points determined. The materials remaining in the autoclave after decantation were washed out using methylene chloride. They were subsquently filtered for determination of coke yield.

The experimental conditions and the results of thermal treatment of Edmonton VTB are tabulated in Table 1-3. These data showed that softening points ranging from 62°C to 94°C were obtained, as compared to 43°C for the original Edmonton VTB.

These data also showed that higher temperatures gave lower yields of the 504°C fraction, but with significantly higher softening points. Figure 1-1 shows the relationship between the yields of the 504°C+ fraction and their softening points with temperature of thermal treatment.

Distillable liquids are significant 'by-products' from thermal treatment of Edmonton VTB. The yields of naphtha and gas, middle distillate, and gas oil are also presented in Table 1-3. They may be recycled back to the refinery, and help defray any processing costs.

Coke formation was observed at higher temperatures (i.e. 415°C and 420°C). This suggested that lower temperature of thermal treatment, but longer residence time, might give better results.

4.2 Thermal Treatment of Bulk Quantities

Because large quantities of thermally treated Edmonton VTB were required, this work was subcontracted to Ontario Research Foundation in Sheridan Park, Ontario. The Edmonton VTB acquired (20 gallons, 50°C Softening Point) was processed in six batches using a 5-gallon autoclave. All the tests were performed under the supervision of Gulf Canada employees. The temperature used in this work was between 405°C and 415°C at a residence time of one hour.

Products from these batch experiments were combined and fractionated at 490-504°C at Gulf R&D. The thermally treated product showed a softening point of 100°C.

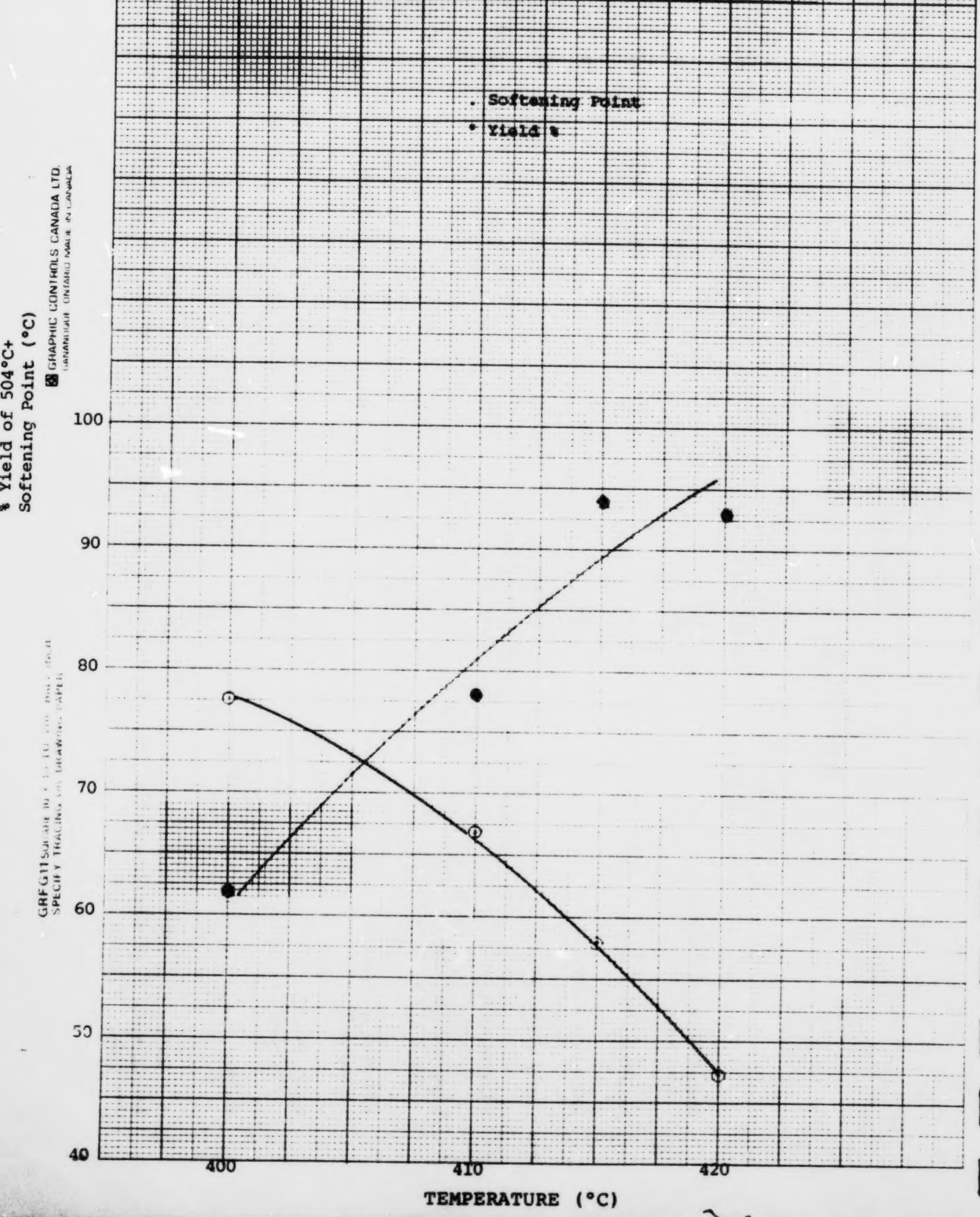
TABLE 1-3

Results of Thermal Treatment of Edmonton VTB

	Edmonton VTB	VTB* From BW-121	VTB* From BW-123	VTB* From BW-129	VTB* From BW-127
Temperature of Thermal Treatment, °C	—	400	410	415	420
Residence Time (min)	—	60	60	60	60
Softening Point, °C	43	62	78	94	93
*** Yield % of VTB*	—	77.7	66.8	58.0	46.9
** % Conversion	—	22.3	33.2	42.0	53.1
% Naphtha and Gas (IBP-200°C)	—	3.3	10.5	6.2	10.3
% Middle Distillate (200-360°C)	—	6.2	6.1	14.1	19.0
% Gas Oil (360-504°C)	—	12.8	16.6	19.1	19.3
% Coke	—	—	—	2.6	4.5

* 504°C+ from ASTM D1160 after thermal treatment
** Conversion of Edmonton VTB to gas, naphtha, middle distillate, gas oil and coke
*** 100% - % Conversion

FIG. 1.1 Effect of temperature of thermal treatment on yield % and softening point



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TASK REPORT #2 - QUALITY AND CHARACTERISTICS OF COAL AND HEAVY RESIDUA SAMPLES

1. INTRODUCTION

This task covers all the analytical and characterization work done on the feedstocks obtained in Task No. 1. Five raw coal samples and four heavy residua samples were analyzed.

2. COAL SAMPLES

All the coal samples were air dried, and screened to generate +1/2", 1/2" x 3/8", 3/8" x 1/4", 1/4"x 16 mesh, and 16 mesh x 0 size fractions. Only the three middle size fractions were analyzed. This work was subcontracted to Birtley Coal and Minerals Testing in Calgary.

2.1 Analysis

Coal samples were analyzed for calorific value, proximate and ultimate analyses (ASTM specifications). The analytical data for Wabumun (WBN), Roselyn (RSN), Wapiti (WPT), Poplar River (PPR), and Coal Valley Clean Coal (CVY) are attached in Table 2-1.

2.2 Petrographic Analysis

Petrographic analysis was subcontracted to David E. Pearson & Associates Ltd. in Victoria. One hundred individual vitrinite grains were measured for reflectance in rank analysis; and 500 grains were counted for maceral analysis. These analyses were performed on two pellets of each sample.

Initially the three size fractions of the Wabaumun coal were analyzed (Table 2-2). Although the data showed that there were differences in total reactives and inerts in size fractions, the distributions of reactives and inerts were similar. Therefore it was felt necessary only to analyze the raw coal samples from Wabumun, Roselyn, Wapiti, Poplar River, and Coal Valley. A summary of the petrographic analysis is also presented in Table 2-2.

This data showed that Roselyn had the highest percentage in vitrinite. From reflectance determinations, Poplar River was the lowest rank, followed by Wabumun and Roselyn, then Wapiti and Coal Valley. Wapiti is of the same rank as Coal Valley by petrographic analysis.

2.3 Coal Characterization

Coal samples and products from this research program were characterized for equilibrium moisture, moisture uptake, porosity, and tendency for spontaneous combustion. Since these tests were performed mainly to compare the handling characteristics of products and their parent coals, the results for coal samples are presented in Task Report #4 (Quality and Characteristics of Upgraded Products) along with the results for products.

The characterization tests used in this research program were specifically designed to provide a realistic assessment of the handling characteristics of coals and products. Therefore the ASTM specification for equilibrium moisture was modified and specific testing procedures were developed for the other tests. A detailed description of the characterization program is presented in Task Report #4.

3. HEAVY RESIDUA SAMPLES

Heavy residua samples were analyzed and characterized by Gulf R&D, except for ultimate analysis (subcontractor was Guelph Chemical Laboratories Ltd., Guelph, Ontario). All the results are shown in Table 2-3.

TABLE 2-1

Calorific Value, Proximate and Ultimate Analyses of Coal Samples

CLIENT: GULF CANADA RESOURCES INC.
PROJECT: COAL RESEARCH PROGRAM (1983)
026683-WBM (2 BARRELS REC'D AUG 18/83)
LAB NO: 5940
DATE: SEPTEMBER 21, 1983

AS REC'D WEIGHT = 355 KG
AIR DRIED WEIGHT = 311 KG
ADM% = 7.2

SIZE AND RAW ANALYSIS, air dried basis

SIZE FRACTION	WT%	RM%	ASH%	VOL%	FC%	CV CAL/GM	CUMULATIVE WT%	 ASH%
+ 1/2"	34.20	13.30	16.20	28.80	41.70	4772	34.20	16.20
1/2" X 3/8"	9.60	12.20	18.50	28.90	40.40	4702	43.80	16.70
3/8" X 1/4"	13.80	12.10	19.40	28.40	40.10	4596	57.60	17.35
1/4" X 16M	28.70	11.70	22.00	27.20	39.10	4411	86.30	18.90
16M X 0	13.70	10.00	32.40	24.30	33.30	3783	100.00	20.75

ULTIMATE ANALYSIS, air dried basis (H DOES NOT INCLUDE H IN H20)

SIZE FRACTION	H20	C	H	N	S	ASH%	0 (BY DIFF)
+ 1/2"	13.32	50.39	3.03	0.94	0.26	16.20	15.86
1/2" X 3/8"	12.23	51.51	2.89	0.90	0.30	18.40	13.69
3/8" X 1/4"	12.14	49.36	2.93	0.83	0.30	19.37	15.07
1/4" X 16M	11.67	46.30	2.29	0.77	0.32	21.99	16.66
16M X 0	10.01	42.74	2.89	0.54	0.29	32.43	11.10

NOTES: — A REPRESENTATIVE SAMPLE HAS SPLIT OUT OFF EACH FRACTION FOR PETROGRAPHY.
— AT LEAST A THREE QUARTER SPLIT (OR MORE) OFF EACH FRACTION PACKAGED IN BAGS/BARRELS FOR SHIPMENT TO GULF, ONTARIO.

CLIENT: GULF CANADA RESOURCES INC.
PROJECT: COAL RESEARCH PROGRAM (1983)
026683-RSN (2 BARRELS REC'D AUG 18/83)
LAB NO: 5941
DATE: SEPTEMBER 21, 1983

AS REC'D WEIGHT = 294 KG.
AIR DRIED WEIGHT = 234 KG.
ADM% = 20.4

SIZE AND RAW ANALYSIS, air dried basis

SIZE FRACTION	WT%	RM%	ASH%	VOL%	FC%	CV CAL/GM	CUMULATIVE WT%	CUMULATIVE ASH%
+ 1/2"	39.50	6.80	16.70	34.70	41.80	5191	39.50	16.70
1/2" X 3/8"	19.20	7.00	10.20	35.60	47.20	5595	58.70	14.5
3/8" X 1/4"	18.60	7.10	9.40	35.90	47.60	5625	77.30	13.3
1/4" X 16M	16.20	6.90	10.30	36.30	46.50	5566	93.50	12.80
16M X 0	6.50	5.90	24.60	31.30	38.20	4638	100.00	13.57

ULTIMATE ANALYSIS, air dried basis (H DOES NOT INCLUDE H IN H20)

SIZE FRACTION	H20	C	H	N	S	ASH%	O (BY DIFF)
+ 1/2"	6.84	56.04	3.89	1.20	0.59	16.68	14.76
1/2" X 3/8"	7.02	59.66	3.39	1.24	0.62	10.18	17.89
3/8" X 1/4"	7.05	59.80	3.92	1.21	0.63	9.44	17.95
1/4" X 16M	6.86	59.18	3.73	1.15	0.66	10.28	18.14
16M X 0	5.90	50.51	3.14	0.76	1.39	24.58	13.72

NOTES: — A REPRESENTATIVE SAMPLE WAS SPLIT OUT OFF EACH FRACTION FOR PETROGRAPHY.
— AT LEAST A THREE QUARTER SPLIT (OR MORE) OFF EACH FRACTION PACKAGED IN BAGS/BARRELS FOR SHIPMENT TO GULF, ONTARIO.

CLIENT: GULF CANADA RESOURCES INC.
PROJECT: COAL RESEARCH PROGRAM (1983)
026683-CVY (1 BARREL REC'D AUG 10/83)
LAB NO: 5942
DATE: SEPTEMBER 21, 1983

AS REC'D WEIGHT = 161 KG.
AIR DRIED WEIGHT = 147 KG.
ADM% = 8.7

SIZE AND RAW ANALYSIS, air dried basis

SIZE FRACTION	WT%	RM%	ASH%	VOL%	FC%	CV CAL/GM	CUMULATIVE WT%	CUMULATIVE ASH%
+ 1/2"	15.70	5.30	10.20	34.70	49.80	6423	15.70	10.20
1/2" X 3/8"	11.20	5.30	10.70	35.30	48.70	6389	26.90	10.41
3/8" X 1/4"	17.60	5.20	10.70	33.80	50.30	6382	44.50	10.52
1/4" X 16M	38.90	5.10	10.30	33.80	50.80	6378	83.40	10.42
16M X 0	16.60	5.10	13.60	31.60	49.70	6000	100.00	10.95

ULTIMATE ANALYSIS, air dried basis (H DOES NOT INCLUDE H IN H20)

SIZE FRACTION	H20	C	H	N	S	ASH%	0 (BY DIFF)
+ 1/2"	5.27	66.91	4.32	0.76	0.30	10.21	12.23
1/2" X 3/8"	5.30	66.67	3.14	0.77	0.32	10.68	13.12
3/8" X 1/4"	5.17	65.86	4.23	0.74	0.31	10.67	13.02
1/4" X 16M	5.14	66.13	4.07	0.72	0.32	10.31	13.31
16M X 0	5.12	63.05	3.72	0.68	0.32	13.63	13.48

NOTES: — A REPRESENTATIVE SAMPLE WAS SPLIT OUT OFF EACH FRACTION FOR PETROGRAPHY.
— AT LEAST A THREE QUARTER SPLIT (OR MORE) OFF EACH FRACTION PACKAGED IN BAGS/BARRELS FOR SHIPMENT TO GULF, ONTARIO.

CLIENT: GULF CANADA RESOURCES INC.
PROJECT: COAL RESEARCH PROGRAM (1983)
WAPITI RAW COAL (2 BARRELS REC'D SEPT 7/83
LAB NO: 6648
DATE: SEPTEMBER 21, 1983

^I132W

AS REC'D WEIGHT = 389 KG.
AIR DRIED WEIGHT = 352 KG.
ADM% = 9.5

SIZE AND RAW ANALYSIS, air dried basis

SIZE FRACTION	WT%	RM%	ASH%	VOL%	FC%	CV CAL/GM	CUMULATIVE WT%	CUMULATIVE ASH%
+ 1/2"	26.50	4.70	34.80	25.70	34.80	4313	26.50	34.80
1/2" X 3/8"	9.10	5.20	31.80	25.80	37.20	4459	35.60	34.03
3/8" X 1/4"	9.40	5.10	31.60	26.50	36.80	4529	45.00	33.52
1/4" X 16M	37.90	7.00	20.10	29.10	43.80	5146	82.90	27.39
16M X 0	17.10	8.60	16.60	30.40	44.40	5156	100.00	25.54

ULTIMATE ANALYSIS, air dried basis (H DOES NOT INCLUDE H IN H2O)

SIZE FRACTION	H2O	C	H	N	S	ASH%	O (BY DIFF)
+ 1/2"	4.65	44.29	3.09	0.78	0.40	34.84	11.95
1/2" X 3/8"	5.19	46.65	2.86	0.67	0.40	31.76	12.47
3/8" X 1/4"	5.12	47.11	3.05	0.61	0.41	31.56	12.14
1/4" X 16M	6.96	50.12	1.78	0.94	0.47	20.10	19.63
16M X 0	8.56	54.18	3.24	1.02	0.55	16.62	15.83

NOTES: — A REPRESENTATIVE SAMPLE WAS SPLIT OUT OFF EACH FRACTION FOR PETROGRAPHY.
— AT LEAST A THREE QUARTER SPLIT (OR MORE) OFF EACH FRACTION PACKAGED IN BAGS/BARRELS FOR SHIPMENT TO GULF, ONTARIO.

CLIENT: GULF CANADA RESOURCES INC.
PROJECT: COAL RESEARCH PROGRAM (1983)
POPLAR RIVER MINE RAW COAL (PPR) REC'D OCT. 4/83
LAB NO: 6976
DATE: OCTOBER 11, 1983

AS RECEIVED WEIGHT = 325 KG.
AIR DRIED WEIGHT = 271 KG.
ADM% = 16.6

HEAD RAW ANALYSIS, air dried basis

MOIST%	ASH%	VOL%	FC%	BASIS	S% *
26.00	12.90	30.00	31.10	adb	0.58
	17.43	40.54	42.03	db	

SIZE AND RAW ANALYSIS, air dried basis

SIZE FRACTION	WT%	RM%	ASH%	VOL%	FC%	CV CAL/GM	CUMULATIVE WEIGHT%
+ 1/2"	76.10	—	—	—	—	—	76.10
1/2" X 3/8"	2.20	21.10	15.60	30.80	32.50	3933	78.30
3/8" X 1/4"	5.10	19.50	17.30	30.50	32.70	3905	83.40
1/4" X 16M	8.60	17.70	20.30	31.40	30.60	3758	92.00
16M X 0	8.00	—	—	—	—	—	100.00

ULTIMATE ANALYSIS, air dried basis (H DOES NOT INCLUDE H IN H20)

SIZE FRACTION	H20	C	H	N	S	ASH%	0 (BY DIFF)
+ 1/2"							
1/2" X 3/8"	21.09	44.86	2.16	0.47	0.55	15.55	15.32
3/8" X 1/4"	19.45	43.97	2.43	0.51	0.65	17.30	15.69
1/4" X 16M	17.77	44.96	2.31	0.55	0.73	20.29	13.39
16M X 0							

NOTES:
- A REPRESENTATIVE SAMPLE WAS SPLIT OUT OFF SIZE FRACTIONS B,C & D FOR PETROGRAPHY. HEAD SAMPLE (HR) SHIPPED TO PEARSON - OCT 11/83
- AT LEAST A THREE QUARTER SPLIT (OR MORE) OFF EACH FRACTION (A TO E) PACKAGED IN BAGS/BARRELS FOR SHIPMENT TO GULF, ONT. TOTAL 2 BARRELS
- SPLIT OF HEAD SAMPLE SHIPPED TO B. LEECE - OCT 5/83

TABLE 2-2

RESULTS OF PETROGRAPHIC ANALYSIS

Summary of Petrographic Analysis of Size Fractions of Wabumun Coal

	1/2" x 3/8"	3/8" x 1/4"	1/4" x 16 m
Distribution of Vitrinite Types			
V-3, %	83.5	87	86
V-4, %	16.5	13	14
Reactive Components			
Vitrinite, %	52.8	48.0	40.1
Reactive Semifusinite Measured (P), %	5.2	5.2	4.6
Exinite, %	0.9	0.8	0.4
Total Reactives, %	58.9	54.0	45.1
Inert Components			
Inert Semifusinite Measured (P), %	18.0	17.0	22.6
Macrinite, %	0.7	0.7	1.4
Fusinite, %	6.7	13.0	11.9
Inertodetrinite, %	4.2	3.3	5.5
Mineral-Matter, %	11.5	12.0	13.5
Total Inerts, %	41.1	46.0	54.9
Petrographic Indices			
Mean Reflectance, %	0.37	0.37	0.365

TABLE 2-2 Continued

RESULTS OF PETROGRAPHIC ANALYSIS

	WBN	RSN	WPT	PPR	CVY
Distribution of Vitrinite Types					
V-1, %				94.5	
V-2, %				5.5	
V-3, %	89.5	70.5			
V-4, %	10.5	29.0			
V-5, %		0.5	2.0		21.5
V-6, %			73.0		78
V-7, %			24.5		0.5
V-8, %			0.5		
Reactive Components					
Vitrinite, %	47.4	74.5	59.2	56.4	59.6
Reactive Semifusinite Measured (P), %	7.8	7.4	2.9	5.2	7.6
Exinite, %	0.6	1.3	1.8	1.4	2.3
Total Reactives, %	55.8	83.2	63.9	63.0	69.5
Inert Components					
Inert Semifusinite Measured (P), %	22.0	3.4	10.7	14.7	18.6
Macrinite, %	0.5	1.3	0.7	1.3	0.5
Fusinite, %	7.4	3.4	5.2	8.2	3.3
Inertodetrinite, %	1.6	0.6	4.6	3.2	0.2
Mineral-Matter, %	12.7	8.1	14.9	9.6	6.1
Total Inerts, %	44.2	16.8	36.1	37.0	30.5
Petrographic Indices					
Mean Reflectance, %	0.37	0.375	0.665	0.145	0.615

TABLE 2-3

Analysis and Characterization of Heavy Residua Samples

	DRB Residuum	210M Asphalt	Montreal Decarb	Thermally Treated Edm. VTB
C, %	84.47	84.37	84.96	87.66
H, %	8.08	9.63	9.48	8.40
* N, %	1.04	0.45	0.82	0.89
O, %	0.17	1.35	0.09	0.38
S, %	6.24	4.2	4.65	2.67
CV (BTU/lb)	17,316	17,731	17,473	17,842
Ni (ppm)	198	69	124	50
V (ppm)	644	135	704	43
Sp. Gravity	1.114	1.0351	1.0697	1.0958
API Gravity	-4.0	5.2	0.7	-2.4
Viscosity (cSt) @ 150°C	2979		3461	990
Softening Point (°C)	96	108	87	100
Penetration @ 25°C	<1	10	—	2

* Guelph Chemical Laboratories Ltd.

TASK REPORT #3 - EXPERIMENTAL PROGRAM FOR COAL BENEFICIATION

1. INTRODUCTION

This task covers all the work conducted in commissioning the equipment newly constructed for this research program (34 runs), and the execution of experimental program for 5 coals and 3 residua samples (204 runs), using a standard procedure developed during the commissioning.

2. EQUIPMENT COMMISSIONING

2.1 Objectives

The objective of equipment commissioning was to establish a standard procedure for the experimental program. The following criteria were used:

- Stable and reproducible temperature profiles
- Water recovery
- Gas yield determination, and
- Minimum residua loss.

2.2 Equipment Description

Reactor

A stainless steel vessel (5" internal diameter, 18" long cylinder) was constructed for the coal beneficiation experiments. This vessel was equipped with a stainless steel top plate which has an opening for gas and water collection.

The vessel is normally filled with residuum about 8" from the bottom (ca 2.6 kg). The vessel is heated by a circular heater ca. 12" from the bottom. The 6" portion not heated is insulated to prevent heat loss.

Four thermocouples were installed in the vessel. Two thermocouples are located at ca. 3" from the bottom to measure temperature of residuum. One thermocouple is located approximately 3" from the top to monitor vapour temperature. Another thermocouple was used to measure the temperature of the top plate to ensure water vapour is not recondensed.

Water and Gas Collection

Water and gas produced in the beneficiation experiments exit from the opening in the top plate via a stainless steel pipe about 8" long. The pipe was heated by heating tapes to prevent water condensation. The length of the pipe also allows the residuum to drain back to the vessel in case of residuum foaming.

The pipe is connected to a water-cooled condenser and a flask immersed in an ice bath for water collection. The non-condensable materials exit from a side opening of the flask to a wet test meter and orsats. The volume of the gases produced was measured and the gases collected were analyzed by low resolution mass spectrometry.

2.3 Establishment of Reaction Conditions

Closed System

The first attempt to establish the experimental procedure was to run the experiments at a constant residuum temperature. This was thought to be feasible by adjusting the temperature of the heater through the controller.

It was found that when experiments were conducted in a closed system, the evaporation/condensation of water, the delay of heater response to the controller, and the delay of heat transfer from reactor to residuum, gave different temperature profiles under similar conditions. Not only were stable and reproducible temperature profiles not obtained, but water removed from coal was also not recoverable quantitatively.

This mode of operation also gave another problem. When the reactor was opened to collect gases, residuum level tended to rise. This resulted in residuum loss in the piping and required clean-up of the apparatus.

Open System

After many trial runs using the closed system approach, a decision was made to try the open system concept. In this mode of operation, water removed from coal was immediately flashed off from the reactor. The temperature of the residuum showed a temperature drop during the immersion; and slowly increased during the run.

Although an attempt was made to maintain constant temperature of operation, it was found that frequent adjustments of the temperature controller was not an ideal way for standard operation.

The open system approach which gave a temperature profile rather than a constant temperature was found to be fairly reproducible. Residuum loss can be minimized by immersion of coal samples in a period of two to three minutes. Stoichiometric quantities of water are also recovered.

Next section gives the standard procedure developed for this beneficiation program.

2.4 Standard Procedure for Coal Beneficiation

1) Fill the reactor with liquid residuum (200°C) to 8 1/2" from the bottom (or 9 1/2" from the top).

2) Close the reactor with a four-neck glass cover. Two necks of this cover are closed with rubber stoppers while the center one is the inlet for N_2 gas and the remaining opening is the exhaust port.

3) During the heat-up period a small stream of nitrogen is flowing through the reactor to prevent oxidation. The nitrogen stream is stopped when the residuum temperature reaches 150°C. The glass cover stays on the reactor until the desired reaction temperature is reached and has stabilized.

4) While the reactor is heated to the reaction temperature the stainless steel column and condenser are attached to the reactor top. Also a wire mesh cage, containing 100 grams of coal, is tied to the lower end of the push rod. Then the push rod with the cage is brought to the most upward position. Now the two tape heaters are connected to the column and reactor top and heating started (110 volts for the reactor top, 80 volts for the column).

5) After the specified reaction temperature has stabilized in the reactor, the glass cover is quickly removed and a heat resistant rubber seal placed into the groove of the reactor. Then the heated metal reactor top bolted with eight bolts to

the reactor vessel (torque 40 ft.lb). A 500 mL Erlenmeyer suction flask is connected to the metal condenser. The flask is connected to a gas sampling system of two parallel orsats (150 mL). The lower end of the sampling system leads into a wet test meter to measure the produced gases during the actual run.

6) As soon as the system is assembled it is flushed with nitrogen for 60 seconds. Exactly 15 minutes after the metal top has been placed on the reactor vessel the run is started, meaning the cage containing the coal is lowered into the residuum very slowly (3 min.). Depending on the predecided reaction time, e.g. 30 min., the coal remains in the residuum at a set temperature (280-320°C) for up to 30 minutes. During this time temperature readings of the residuum, the reactor top part (inside and outside) as well as of the column are recorded every minute. The gas volume is also recorded every minute for the first three minutes after which the first gas sample is taken, since during the initial three minutes most gases from the coal are liberated. During the rest of the run every five minutes the gas volume is recorded. After the predecided reaction time, in the above case 30 minutes, a second gas sample is taken and the coal-containing cage is pulled out of the residuum and left suspended for another 15 minutes in the closed reactor. During this time a slight vacuum is applied to the system to draw all the water into the suction flasks. The flask is submerged during the run in ice water.

7) Following the vacuum period nitrogen is allowed to enter the system. Now the reactor top can be taken off and the cage emptied of the reaction product. The product is weighed. The suction flask is also weighed and then the liquid transferred with toluene to a 500 mL round bottom flask. To this flask the washings (toluene) of the metal condenser are added. Now the flask is set up with a Dean-Stark trap and a reflux condenser and the liquids refluxed for at least two hours to determine the water content.

3. EXPERIMENTAL PROGRAM

A total of 238 batch experiments were conducted in this program. Wabumun coal (W) and Poplar River lignite (P) were selected for detailed evaluation; Wapiti (T), Roselyn (R), and Coal Valley (C) were examined on a reduced program. The three residua used were Edmonton VTB (E), DRB Pelican Residuum (D), and Montreal Decarb Asphalt (M). A breakdown of the number of experiments conducted in each series is presented below:

Program	# of Experiments
Pre-experiment program (establishing experimental conditions)	34
WD series	27
PD series	31
WM series	27
PM series	27
WE series	28
PE series	16
TE, RE and CE series	24
TM, RM, and CM series	12
TD, RD, and CD series	12
TOTAL	238

TASK REPORT #4 - QUALITY AND CHARACTERISTICS OF UPGRADED PRODUCTS

SUMMARY

Although this task investigates both product quality and product characteristics as compared to those of their raw coals, detailed descriptions of product quality are presented in Task Report #5. Consequently only the handling characteristics are discussed here.

The products from Gulf's Beneficiation Method show superior handling characteristics than their raw coals. Equilibrium moisture determination, porosity determinations, and moisture pick-up tests all show that approximately 50-60% of the pores of the raw coals were plugged or surface covered by residuum. As a result, the products show less tendency for combustion.

However, optimization of this beneficiation method for each coal is necessary to achieve higher reduction of pore volume. This will ensure good product quality in storage.

1. INTRODUCTION

This task covers the analyses and characterizations of the upgraded products from coal beneficiation. The results of characterizations of the raw coals are also reported here for easy comparison. Proximate and ultimate analyses were subcontracted to Loring Laboratories Ltd. in Calgary; calorific value, sulfur content and residuum content, and all the characterization parameters were determined by Gulf R&D.

2. ANALYSIS

2.1 Specifications

Standard methods are used in product analysis. The specification numbers/instruments used in analysis are listed below:

- proximate analysis - ASTM D3173, D3174, D3175
- ultimate analysis - ASTM D3177, D3178, D3179 using Lindberg C/H furnace
- calorific value - ASTM D3286 using Autocalorimeter Leco AC-200
- sulfur value - ASTM D3177 using sulfur analyzer Leco SC-32

2.2 Residuum Content Determinations

The residuum contents of upgraded products were determined by Soxhlet extraction of pulverized products. Methylene chloride was used as the extraction solvent.

Two methods of determining residuum contents were examined. In the direct method, the solvent containing residuum was evaporated using a rotary evaporater until the content in the evaporating flask reached a constant weight. In the indirect method, the thimble with the methylene chloride insoluble materials was dried under vacuum, weighed and compared to the original charge. Table 4-1 compares the residuum contents of selected samples determined by using the direct and indirect methods.

As the indirect method gave comparable results to the direct method, its reproducibility was checked as shown in Table 4-2. Consistent results were obtained from different operators.

3. CHARACTERIZATION

Both the products and raw coals were subjected to a characterization program to evaluate their handling characteristics. The characterization program covers assessment of pore volume (porosity and equilibrium moisture determinations), and reabsorption of moisture (moisture uptake test and tendency for spontaneous combustion). The methods used and the results obtained are discussed below.

3.1 Methods

All the methods used to characterize products and raw coals are not standard tests. In fact, standard tests, if available, were modified so that a fair assessment of the handling characteristics could be obtained. The need for modifications of standard methods is due to the fact that products from this beneficiation method are surface coated by petroleum residuum so destruction of the surface (e.g. by crushing) would not give a true indication of the characteristics of the actual product. All the characterization tests were therefore performed on particles of the original sizes (i.e. 1/2" x 3/8", 3/8" x 1/4", 1/4" x 16 mesh), for both products and raw coals.

Equilibrium Moisture

The equilibrium moistures of coal and products were determined by a modified method of ASTM specification D1412-74. The only change in this method was that the original particle size (i.e. 1/2" x 3/8", etc) coals were used instead of crushed samples (16 mm x 0).

Porosity

Data on porosity were obtained by using the mercury intrusion method (Micromeritics). Samples were placed in a penetrater (15 cc) and mercury was intruded into the pores at different pressure levels up to 30,000 psi (206.8 MPa). The mercury intrusion method gives data on percentage pore volume (cc/cc), bulk density (g/cc), apparent density (g/cc) and mean pore diameter.

As it is extremely difficult to obtain good representative samples from this quantity of material, at least duplicate runs were performed on each sample. While the absolute values of each set of data may not be entirely accurate, the relative values between the products and raw coals should give some insight of the pore volume before and after treatment.

Tendency for Spontaneous Combustion

The tendency for spontaneous combustion was evaluated by monitoring the temperature rise of coal/products under an oxygen flow saturated with water vapour. About 300 g of samples were placed in a Dewar inside a constant temperature oven. The oxygen was preheated in a heating coil. The temperature of the samples were monitored and compared with the gas temperature. Due to the use of original particle size, 150 mL/min of oxygen preheated and controlled at 90°C was used in these determinations.

Again emphasis is placed on the relative behaviour of coal and product samples to compare their tendencies for autogenous heating.

Moisture Pick-up

Moisture pick-up properties were determined by the weight gain of a dried sample, after certain given time intervals in a humidity chamber (80°F, 100% R.H.). Samples from the humidity chamber were then air dried to determine moisture release characteristics.

3.2 Results

Equilibrium Moisture

The results of equilibrium moisture determinations of raw coal and products are presented in Table 4-3. The values presented are average values of at least two runs.

Reductions of equilibrium moisture ranging from 44% to 80% were observed. Since equilibrium moisture represents the moisture levels of coal and products under a fully saturated environment (bed moisture), it is not expected that coal and products will return to these moisture levels in a normal situation. In fact, equilibrium moisture determination was devised as a means of estimating bed moistures.

Equilibrium moisture, however, can be considered as a means to estimate pore volume. It is much easier to determine and less time consuming than pore volume determinations by mercury intrusion method.

Porosity

The results of pore volume determinations by mercury intrusion method are presented in Table 4-4. Due to the difficulty in obtaining a good representative sample, at least two runs were conducted for each sample. The values shown are average values of duplicate or triplicate runs.

In general, pore volumes determined by mercury intrusion method are higher than those estimated by equilibrium moisture determinations. This was expected because the mercury intrusion method was operated under high pressure (up to 30,000 psi) which can push mercury into the very fine pores.

The reductions of pore volumes, however, are quite comparable with the reduction in equilibrium moisture. Since our main concerns are the relative magnitude of pore volumes for raw coal and products, both methods are useful tools in this assessment.

The mercury intrusion method for pore volume determinations, of course, gives more information (Table 4-5). Not only bulk and apparent densities are available, but also the mean pore diameters are estimated. Mean pore diameters determined on raw coals and products showed that the pore diameter of products are considerably smaller than that of their parent coals. This seems to suggest that there is a limit for residuum penetration when the molecular size of residuum is larger than the pore diameter. It also suggests that reduction of pore volume may also depend on the pore size distributions of the parent coals. Continuation of these conclusions would require a detailed investigation of pore structure based on good representative samples.

Tendency for Spontaneous Combustion

The results of the evaluation of the tendency for spontaneous combustion are presented in Fig. 4-1.

Temperature rises in raw coal samples are significantly higher than those observed for the products. For raw coal samples, temperature rises ranged from 15-20°C within 3 to 4 hours; for products, temperature rises were only 5-6°C in the same time period. It should be mentioned that not only the temperature rises are significantly different, but the rates of temperature rise are also much higher in the raw coals. Since spontaneous combustion is based on reabsorption of water, which generates heat that accelerates coal oxidation, these curves are consistent with the observations that the pore volumes are greatly reduced but not entirely sealed by residua.

These tests show exclusively that the products have less tendency for spontaneous combustion than their parent coals. This improvement, together with the elimination of dusting problem, should make the products from low rank coal more competitive in the thermal coal markets.

Moisture Pick-up

The results of moisture pick-up tests are presented in Table 4-6. In this test, samples were predried at 105°C for 2 hours, kept in a humidity chamber (80°F, 100% R.H.) for 100 hours, then air dried and weighed every 24 hours afterwards up to a total of 96 hours.

All the products after the humidity chamber have approximately 50% of the water content shown by their raw coals. This is consistent with the observations of equilibrium moisture and porosity. This moisture, a large part of which is on the surface, is rapidly released from both coal and products; and after 96 hours of air drying, the raw coals appeared to reach their residual moisture levels, while the moisture levels of the products were significantly below that of their raw coals in the same time period.

It should be emphasized that the moisture pick-up test is an empirical method and the results should be viewed as indications rather than absolute values. In general, they confirm observations in all other tests in the characterization program and indicate what might happen in an extremely wet atmosphere.

TABLE 4-1

Comparisons of Residuum Content Determinations by Direct and Indirect Method

Sample #	Direct Method	Indirect Method
WD-1	6.9	6.6
WD-2	13.4	14.1
WD-3	8.0	7.6
WD-4	6.3	6.5
WD-5	6.9	5.0
WD-6	6.3	5.0
WD-7	6.4	4.3
WD-8	11.2	10.3
WD-9	12.3	11.5

TABLE 4-2

Reproducibility of Residuum Content Determined by Indirect Method

Sample #	Operator 1	Operator 2	Operator 3
WD-14	8.2	8.0	
WD-15	13.5	13.6	
WD-12	17.0	16.5	
WD-23	19.4	18.2	
WD-24	15.5	16.5	
PD-8	14.1	15.2	16.5
PD-3B	19.4	20.8	21.5
PD-7	13.7	14.8	
PD-9		13.7	14.5
PD-10		17.9	17.6

TABLE 4-3

Equilibrium Moistures of Raw Coal and Products

Raw Coal		Product		% Reduction of Eq. M.
Sample	Eq. M. %	Sample	Eq. M. %	
W-S1	17.6	WD-S1	7.4	57.9
		WM-S1	7.2	59.1
		WE-S1	7.6	56.8
W-S2	16.7	WD-S2	7.9	52.7
		WM-S2	8.1	51.5
		WE-S2	9.1	45.5
W-S3	16.7	WD-S3	9.2	44.9
P-S1	24.0	PD-S1	12.4	48.3
		PM-S1	12.0	50.0
P-S2	24.2	PD-S2	11.5	52.5
		PM-S2	12.0	50.4
P-S3	25.3	PD-S3	13.1	48.2
C-S1	8.7	CD-S1	3.5	59.7
C-S2	8.8			
C-S3	9.2			
R-S1	19.4	RD-S1	3.9	79.9
R-S2	19.5			
R-S3	19.6			
T-S1	6.5	TD-S1	3.4	47.7
T-S2	7.2			
T-S3	10.2			

W = Wabumun
P = Poplar River
C = Coal Valley
R = Roselyn
T = Wapiti

S1 = 1/2" x 3/8"
S2 = 3/8" x 1/4"
S3 = 1/4" x 16 mesh

TABLE 4-4

Pore Volumes (% v/v) of Raw Coals and Products

Raw Coal		Product		
Sample	% Pore Vol (cc/cc)	Sample	% Pore Vol (cc/cc)	% Reduction of Pore Vol
W-S1	23.0	WD-S1	10.8	53.0
		WM-S1	9.4	59.1
		WE-S1	9.7	57.8
W-S2	22.4	WD-S2	9.9	55.8
		WM-S2	6.9	69.2
		WE-S2	10.9	51.3
W-S3	23.7	WD-S3	10.0	57.8
P-S1	18.3	PD-S1	11.6	36.6
P-S2	16.8	PD-S2	11.0	34.5
P-S3	45.9	PD-S3	12.2	73.4
C-S1	11.3			
R-S1	16.4			
T-S1	9.8			

W = Wabumun
P = Poplar River
C = Coal Valley
R = Roselyn
T = Wapiti

S1 = 1/2" x 3/8"
S2 = 3/8" x 1/4"
S3 = 1/4" x 16 mesh

TABLE 4-5

Bulk Density, Apparent Density and Mean Pore Size of Raw Coal and Products

Raw Coal				Product			
Sample	Bulk Density (g/cc)	Apparent Density (g/cc)	Mean Pore Diameter (m)	Sample	Bulk Density (g/cc)	Apparent Density (g/cc)	Mean Pore Diameter (m)
W-S1	1.1975	1.4732	2.5	WD-S1	1.3218	1.4653	0.52
				WM-S1	1.2689	1.3878	0.02
				WE-S1	1.2736	1.3983	0.11
W-S2	1.1969	1.4630	55	WD-S2	1.4535	1.6196	0.76
				WM-S2	1.3376	1.4302	0.03
				WE-S2	1.2609	1.4071	0.41
W-S3	1.0921	1.5549	30	WD-S3	1.3717	1.5093	0.05
P-S1	1.2728	1.5050	0.58	PD-S1	1.3908	1.5541	0.06
P-S2	1.3327	1.5561	0.25	PD-S2	1.3699	1.5213	0.09
P-S3	0.9885	1.4438	40	PD-S3	1.3417	1.5041	7.1
C-S1	1.3358	1.4888	2.6				
R-S1	1.1157	1.2984	4.0				
T-S1	1.3290	1.4593	0.54				

TABLE 4-4

Pore Volumes (% v/v) of Raw Coals and Products

Raw Coal		Product		
Sample	% Pore Vol (cc/cc)	Sample	% Pore Vol (cc/cc)	% Reduction of Pore Vol
W-S1	23.0	WD-S1	10.8	53.0
		WM-S1	9.4	59.1
		WE-S1	9.7	57.8
W-S2	22.4	WD-S2	9.9	55.8
		WM-S2	6.9	69.2
		WE-S2	10.9	51.3
W-S3	23.7	WD-S3	10.0	57.8
P-S1	18.3	PD-S1	11.6	36.6
P-S2	16.8	PD-S2	11.0	34.5
P-S3	45.9	PD-S3	12.2	73.4
C-S1	11.3			
R-S1	16.4			
T-S1	9.8			

W = Wabumun
P = Poplar River
C = Coal Valley
R = Roselyn
T = Wapiti

S1 = 1/2" x 3/8"
S2 = 3/8" x 1/4"
S3 = 1/4" x 16 mesh

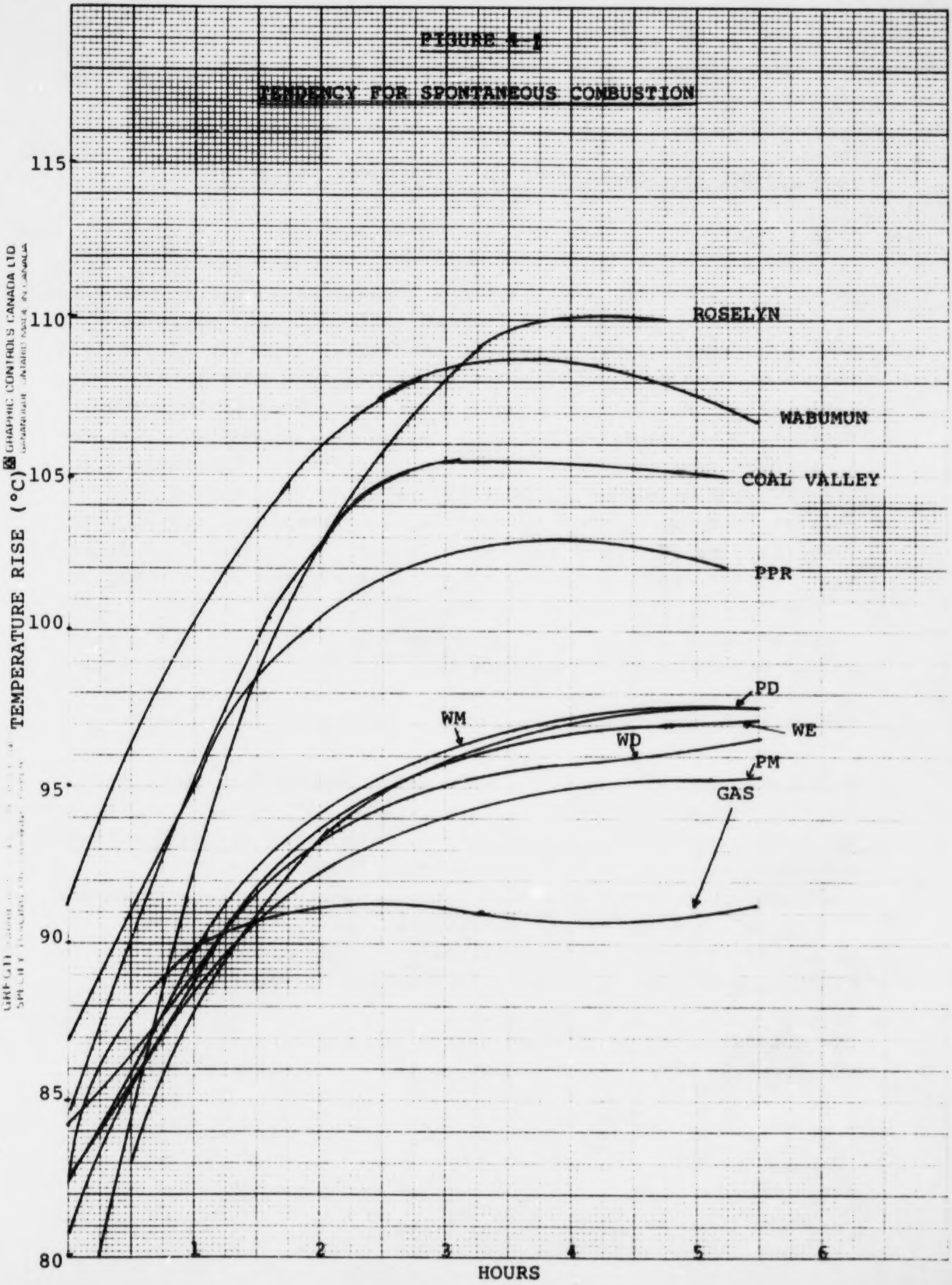
TABLE 4-6

Humidity Chamber Test

Sample	% Water After 100 hours in Humidity Chamber 80°F, 100% R.H.	% Water After 24 hours of Drying	% Water After 96 hours of Drying
WBN (Raw Coal)	24.9	14.6	11.2
WE	12.5	8.8	6.1
WD	14.1	7.4	5.5
WM	14.8	8.9	6.3
PPR (Raw Coal)	35.2	23.9	19.3
PD	20.0	11.3	8.1
PM	17.8	11.2	8.2
CVY (Raw Coal)	13.3	7.0	5.4
CD	7.2	4.2	3.1
RSN (Raw Coal)	23.3	13.8	10.2
RD	17.6	9.2	6.3

FIGURE 4-1

TENDENCY FOR SPONTANEOUS COMBUSTION



TASK REPORT #5 - EVALUATION OF EXPERIMENTAL RESULTS

TASK SUMMARY

In this program, the fact that the feedstocks were coal particles of various size ranges made it more difficult than anticipated to obtain consistent representative samples. Corrections therefore had to be made to the data to allow for sample to sample variation. In addition, since it was not practical to change the residuum after every experiment, change in residuum quality over time covering a number of experiments was not determined and this created some difficulties in interpretation of the results. However, despite these difficulties, some important trends were identified based on the average values for a number of experiments taken at different reaction temperatures and residence times.

The conditions required for processing high moisture coals were well established as a result of this program. For low moisture coals, further investigations will have to be carried out to determine optimum conditions.

A temperature range from 240°C to 280°C appeared to be suitable for all the coals studied in this program. This temperature range was high enough to give a product of reasonable residuum content, but low enough to prevent excessive cracking of petroleum residuum. Residence times of 10 to 20 minutes were required for high moisture coals to ensure satisfactory coating of coal particles; however, shorter residence times (<10 minutes) may be feasible when low moisture coals are used as feedstocks.

The moisture content of feedstocks, and their particle size have the greatest effect on residuum content, and all the related qualities. The smaller the particle size, the greater the binding of coal particles together. Also, the effect of residuum quality on residuum content appeared to be related to their softening points. The higher the softening point, the higher the residuum content on the product because the residuum was drained off less effectively.

All the product qualities are related to the residuum content of the products. Therefore, the moisture content of the feedstocks, and their particle size have important effects on product qualities. The quality of the residuum, especially the sulfur content, is an important factor in meeting the sulfur specification of thermal coals.

When low sulfur-containing residuum (e.g. thermally treated Edmonton VTB) is used, Wabumun subbituminous coals are upgraded significantly in calorific value, and within sulfur specifications. When high sulfur-containing residua are used, an effort to minimize residuum content of the product will be required.

Except for low moisture coals, all the upgraded products showed significant increases in calorific value and volatile matter content. While ash content was increased moderately, the products were practically water free. Sulfur content increased depending on the sulfur content of the residuum used as immersion media. Ultimate analysis showed that products contained more carbon and hydrogen but less oxygen than their parent coals. Labile oxygen in the coal structures was removed and this was confirmed by the high concentrations of carbon dioxide determined in the off-gas.

1. INTRODUCTION

Task 5 deals with the evaluation of the experimental results obtained in this research program. The evaluation covers the study of processing variables, and examines the qualities of the upgraded products.

Five variables are studied in the experimental program. These are: coal quality, coal particle size, residuum quality, reaction temperature, and residence time. The qualities of the upgraded products are examined by various parameters: proximate analysis, heating value, and residuum content on all products, and sulfur and ultimate analysis on a selected basis.

The handling characteristics of the upgraded products and their parent coals are compared for equilibrium moisture, pore volume, moisture pick-up properties and tendency for spontaneous combustion. These are described in detail in Task Report #4.

By-products of the beneficiation experiments are also determined and analyzed. Water collected from each run was recovered and determined. Gases collected from selected runs were measured and analyzed.

A flow diagram illustrating the beneficiation experiments is given in Figure 5-1.

2. TERMINOLOGY

The symbols used in this task report are discussed below:

2.1 Coal Samples

W	Wabumun subbituminous coal
R	Roselyn subbituminous coal
T	Wapiti Bituminous coal
P	Poplar River lignitic coal
C	Coal Valley bituminous coal (clean product)

2.2 Residuum Samples

D	DRB Residuum (Pelican heavy oil)
M	Montreal Decarb Asphalt
A	210 Melt Asphalt
E	Thermally treated Edmonton Vacuum Tower Bottoms

2.3 Experiments

WD Series	Wabumun subbituminous coal and DRB residuum
PE Series	Poplar River lignitic coal and thermally treated Edmonton Vacuum Tower Bottoms
WD-7	Run #7 of the WD Series
P3-D-2	Run #2 of the PD Series. Coal size is S3.
S_1, S_2, S_3	Size fraction 1/2" x 3/8", 3/8" x 1/4", and 1/4" x 16 mesh respectively
T_1, T_2, T_3	Temperatures of immersion (different for different series)
L_1, L_2, L_3	Residence time 10 minutes, 20 minutes, and 30 minutes respectively

2.4 Products

Product	Upgraded product consisting of upgraded coal and residuum
Upgraded Coal	The coal portion of product after discounting the residuum portion

2.5 Analytical Data, Computed Values, and Formulas

Symbol	Definition	Formula
2.5.1 Coal		
A	Ash, % wt of coal	
RM	Residual Moisture, % wt of coal	
S	Sulfur, % wt of coal	
BTU (coal)	Heating value of coal in BTU/lb	
S (*)	Sulfur, % wt of coal, dry basis	$S(*) = S\% \times \frac{100}{100 - RM}$
2.5.2 Residuum		
BTU (Res)	Heating value of Residuum in BTU/lb	
S_R	Sulfur, % wt of residuum	
2.5.3 Product		
Y_P	Product Yield, % wt	$\frac{\text{wt of product}}{\text{wt of coal}} \times 100\%$
R_P	Residuum, % wt on Product (determined by Soxhlet extraction)	$\frac{\text{wt of } CH_2Cl_2 \text{ solubles}}{\text{wt of product}} \times 100\%$
$(R_P)_C$	% wt Residuum used for feed coal	$R_P \times Y_P/100$
$(R_P)_s$	Calculated residuum % wt of product based on sulfur balance	$100 \times [\frac{S_P - S(*)}{S_R - S(*)}]$

2.5.3 Product Continued

Symbol	Definition	Formula
A_P	determined Ash, % wt of Product	
$(A_P)_C$	calculated Ash, % wt of Product	$100 \times A/Y_P$
S_P	determined Sulfur, % wt of Product	
BTU (product)	determined heating value for product in BTU/lb	
BTU (det'n) (MAF)	Heating value of product from determination, on moisture-ash free basis	$\text{BTU (product)} \times \frac{100}{(100 - A_P)}$
F	Adjustment factor for ash variation due to sampling	$\frac{100 - A_P}{100 - (A_P)_C}$
BTU (cal)	Calculated BTU value for product	$(100 - R_P) \times \text{BTU (coal)}/(100-\text{RM})$ $+ \text{BTU (res)} \times R_P/100$
BTU (cal) (adj)	Calculated BTU value for product adjusted to ash level as determined	BTU (cal) x F
BTU RE (Product)	Energy Recovery of Product compared to input coal	$\frac{Y_P \times \text{BTU (product)}}{\text{BTU (Coal)}}$
BTU RE (Product) (adj)	Energy Recovery of Product compared to input coal, after adjustment	BTU RE (Product)/F

2.5.3 Product Continued

Symbol	Definition	Formula
BTU RE (upgraded coal)	Energy Recovery of Upgraded Coal compared to input coal	$\dfrac{Y_P \times \text{BTU (product)} - \dfrac{Y_P x R_P}{100} \times \text{BTU (RES)}}{\text{BTU (coal)}}$
BTU RE (upgraded coal) (adj)	Energy Recovery of Upgraded Coal compared to input coal, after adjustment	BTU RE (upgraded coal)/F

3. DATA ADJUSTMENT AND PRESENTATION

3.1 Data Adjustment

Analysis of upgraded products from the same size fraction showed a wide variation in ash content. These variations were larger when larger particle size of coal was used in the experiments. As the product yields from the same size fraction are generally quite comparable, these variations undoubtedly are caused by difficulties in obtaining a small representative raw coal sample (100 g) for use in the batch experiments.

The failure to obtain representative raw coal samples not only changes the ash value of the products, but also changes the heating values, and the results of the proximate and ultimate analyses. Adjustment of these results to correct for sampling difficulties, therefore, must be made before any interpretation is carried out. The basic formula for adjustment is discussed in Section 2.5.

In order to make adjustment for ash variations, to ascertain that all the analytical data are reasonably accurate, and to expedite repetitive calculations, the computer program "Data Checking" was written. This program first calculates the theoretical ash content of the product, compares this with the ash content as determined, and arrives at an adjustment factor. This factor was then applied to the theoretical heating value of the product to check the accuracy of heating value from the determination, and for calculations of BTU recoveries. Furthermore, the program "Data Checking" also compares the residuum contents as determined with those obtained from a sulfur balance calculation.

Finally, adjustments are also made to the results of the ultimate analysis of the product to give compositional balances. In addition, the computer program "Balance" also prints out mass and BTU balances for selected beneficiation experiments.

3.2 Data Presentation

For easy comparison, a standard format has been used to present the results for each series. This format consists of up to six tables as listed below in each series.

Table 1	Summary of Experimental Results (Average Reaction Temperature, Product Yield, Water Recovered, Gas Volume, and Residuum Content of Products)
Table 2	Proximate Analysis, Heating Value, and Sulfur Content of Products
Table 3	Ultimate Analysis of Selected Products
Table 4	Ultimate Analysis of Selected Products (Adjusted)
Table 5	Printouts of Computer Program "Data Checking" for all Runs
Table 6	Printouts of Computer Program "Balance" for Selected Runs

All these data are presented in Appendix 1 of this report.

Because of the massive amount of analytical data available for each series, the consolidated approach of reporting the average value is extensively used in the text. This approach also tends to reduce the random error inherent in each individual experiment.

4. RESULTS AND DISCUSSIONS

Two high water-content coals (Wabumun and Poplar River) were studied in detail in this experimental program. Randomized experiments covering 3 different residua, 3 size fractions, 3 reaction temperatures, and 3 residence times were conducted using these two coals.

Three low water content coals (Wapiti, Roselyn, and Coal Valley) were used as feedstocks in a reduced program. Experiments covering 3 different residua, but only 2 size fractions, 2 reaction temperatures, and one single residence time were carried out on these feedstocks.

4.1 General Comments on the Effect of Processing Variables

Five processing variables were studied in this experimental program: coal quality, residuum quality, coal particle size, reaction temperature, and residence time. While the first three variables showed definite effects on product yields and qualities, reaction temperature and residence time did not seem to be important factors. Since the effects of processing variables are discussed in detail in the following sections only brief comments are given here to provide the background as to why average values of data at different temperatures and residence time can be used for discussion.

Residence time, in all experiments, shows an insignificant effect on product yields and qualities. The small effect of residence time, therefore, permits data combination for investigation of the effect of reaction temperature. This is also why only a single residence time was used in the experiments in the reduced series covering Wapiti, Roselyn and Coal Valley coals.

Reaction temperature, in general, only shows a small effect on product yields, and does not give any consistent trend. Therefore, it is possible to combine all the data obtained at different temperatures and various residence times to assess the effects due to coal quality, residuum quality, and coal particle size. This is also why only two reaction temperatures were used in the experiments in the reduced program.

The effects of each of the five processing variables on product yields and qualities, on a qualitative basis, are summarized in Table 5.1.

It should be pointed out that product yields and all product qualities are heavily interlinked to each other. For example, residuum content is not ony part of the product yield, but also influences volatile matter content, sulfur content, calorific value, etc. Therefore, the large effect of particle size on product yield and sulfur content is really related to the large effect of particle size on residuum content. Table 5-1 does not distinguish the direct or indirect natures of the effects of processing variables on product yields and qualities.

4.2 Residence Time

Residence times of 10, 20, and 30 minutes were used in experiments using Wabumun and Poplar River coals. A single residence time (20 minutes) was selected for the program covering Wapiti, Roselyn, and Coal Valley coals. In all experiments, residence time showed little effect on product yields and this is shown by the more specific data presented in Appendix 1.

However, there are indications that a shorter residence time may be more beneficial for processing low water content coals. Low water content coals generally showed a poorer BTU recovery at a 20 min. residence time. For high water content coals, the optimum range of residence time appears to have been well covered. Further data needs to be collected for the low moisture coals.

4.3 Reaction Temperature

Reaction temperature reported for each experiment (Appendix 1) is the average value of the residuum temperature profile. When coal samples at considerably lower temperatures were immersed in hot residuum, the temperature of the immersion media dropped. Temperature drops of 5°C to 35°C, proportional to the moisture contents of the feed coals, were observed. A slower rate of temperature drop was also observed when a higher moisture coal was immersed.

Once the water removal process was completed, the temperature of the medium (coal and residuum) started to rise again. Because temperatures were changing all the time during the experiments, the average value of the temperature profile was used to indicate reaction severity.

The direct effects of reaction temperature were measured by the water recovered, the gas produced, and the product yields obtained in each experiment. Experimental results showed that reaction temperature has no significant effect on water recovery and gas production.

The effect of temperature on product yield is shown in Figure 5-2 and Figure 5-3 for Wabumun coal and Poplar River coal, respectively. For size fractions S1 (1/2" x 3/8") and S2 (3/8" x 1/4"), small but inconsistent effects were observed. For size fraction S3 (1/4" x 16 mesh) the product yield decreased as reaction temperature increased. This was observed as a general trend. It is believed that this is caused by more thermal decomposition/ degradation of fine particles occurring at higher temperatures.

The temperatures studied in each series are summarized in Table 5-2.

4.4 Yield Structures

This section discusses the various factors influencing yield structures in the beneficiation process. The yield structures comprise residuum content of product, water recovered, gas produced, product yield and unaccounted materials. The yield structures for each series are presented in Table 5-3.

4.4.1 Residuum Content

Residuum content of products depends heavily on particle size and water content of high moisture coals. It also appears to be related to the softening point of the residua. Although higher residuum contents were observed at low reaction temperature (200°C, Appendix 1), in general it does not seem to be dependent on either reaction temperatures (above 200°C) or residence time.

Residuum content increased as particle size decreased. The effect of particle size on residuum content is shown in Figure 5-4 for Wabumun and Poplar River coals. When small particle sizes are used, residuum appears to act as a binder in addition to plugging the coal pores. Residuum content, therefore, increased sharply due to the large surface area available in the fine particle size fractions.

The non-uniform binding action of the small particles also gave much larger variations in residuum content in each individual experiment (Appendix 1).

The effect of water content in high moisture coals (i.e. Wabumun and Poplar River) on residuum content is also shown in Table 5-3 and Figure 5-4. Residuum contents on the two large size fractions of Poplar River coal were an order of magnitude higher than those on the corresponding size fractions of Wabumun coal. When residuum contents are related to the water contents of these two feedstocks, the results are shown in bar charts in Figure 5-5. More displacement of water by residuum was observed in Poplar River coal using DRB and Montreal Decarb residua (assuming the residuum required for surface coating are equal). This seems to suggest that more residuum penetrates into the pores of the lignites. The fact that similar results were not obtained with Edmonton VTB upon these two coals was probably due to the longer draining period used in the P-E series.

Results of experiments using the same coal but different residua showed that Montreal Decarb gave the lowest residuum content, followed by DRB residuum and thermally treated Edmonton VTB (Figure 5-4). These seemed to be related to the softening point of the residuum as shown in Figure 5-7 (87°C for Montreal Decarb, 96°C for DRB residuum and 100°C for thermally treated Edmonton VTB). The lower the softening point, the easier the residuum to be drained off after the experiment. The somewhat higher residuum contents using the Edmonton VTB product are also partially caused by the very low temperature (200°C) used in this particular series. The history of residuum, and the packing configurations of coal in the cage may also affect the final residuum content, but these effects cannot be quantified.

4.4.2 Water Recovered

Stoichiometric quantities of water in the parent coals were recovered under all operating conditions in all experimental series. None of the processing variables seemed to have any effect on water removal.

However, it should be pointed out that when very high water content coal (Poplar River) was treated for a short residence time, some products were not fully coated with residua. On the other hand, all the low water content coals appeared to have more decomposition or degradation (Section 4.4.4). This seems to suggest that residuum is taken up after the water removal process has been completed. Coals suffer a higher degree of thermal decomposition (degradation) when less water is present under the same conditions. Higher moisture coals therefore require longer residence time for successful coating; and lower moisture coals could probably be processed under less severe conditions.

4.4.3 Gas Production

Gas samples were collected only for the WD and PD series. Gas production (about 2 litres) remained fairly constant for all residence times, at all reaction temperatures, and for all size fractions.

No correction for gas production from residuum cracking was made for the average values reported in Table 5-3. Extremely small amounts of gas were collected for the reference runs when DRB residuum was heated to reaction temperatures. Even without correction, the average volume of gas from coal decomposition represents less than 1% wt. of the coal feed.

The composition of the reference gas is mainly hydrocarbon gases with minor quantities of hydrogen sulfide. The $(CO + CO_2)/CH_4$ ratio varied from 0.02 to 0.17. The composition of "coal" gas, on the other hand, was mainly carbon dioxide, methane, with varying amounts of carbon monoxide. The ratio of $(CO + CO_2)/CH_4$ varied from 1 to 8 for Wabumun subbituminous coal, and from 7 to 50 for Poplar River lignite, on a mass basis. This ratio did not seem to have a close correlation with temperature; although a general trend was suggested with residence time in the case of Wabumun subbituminous coal. These ratios are plotted in Figure 5-8 and 5-9 to illustrate these relationships.

The differences in $(CO + CO_2)/CH_4$ ratios in "coal" gas and "residuum" gas indicated that some oxygen was removed from coal, although in a minor quantity.

4.4.4 Product Yields

Actual and calculated product yields are compared in Table 5-3. The calculated product yield assumes that only water was removed and was replaced by a determined level of residuum. Comparison with product yields from actual determinations, however, showed that some decomposition or degradation was also taking place. Yields of upgraded coal (product yields after discounting residuum content) were also tabulated in Table 5-3 to show these discrepancies. The materials unaccounted for which are the difference between calculated and actual product yields, are materials that were not determined or detected in the experimental program.

The term degradation used here denotes physical breakage of coal particles to a size smaller than about 28 mesh. The term decomposition means conversion of solid materials into other physical states. Since the quantities of gas collected in these experiments are small, the majority of the unaccounted material must stay with the residua. These could be fine coal particles generated by size degradation, or coal liquids produced at the reaction temperatures. A detailed examination of the residuum after reaction is required to pinpoint these possibilities.

The effect of coal particle size is shown in the generally larger amount of unaccounted materials observed for the fine particle size fraction. The effect of residuum quality, as expected, does not seem to be an important factor here. However, the effect of moisture content of the feed coals appears to be quite important in the amount of unaccounted materials.

Upgraded coal was plotted in Figure 5-10 and Figure 5-11 as a function of moisture content, and referenced to the theoretical curve where only water was removed. It was shown that more decomposition/degradation occurred when low moisture coals were processed under the same conditions. This suggests that low water coals should be processed under less severe conditions to avoid BTU loss.

The observation of higher residuum content for higher water content coals, however, was not supported by low water content coals (Wapiti, Coal Valley, and Roselyn). In fact, all these coals gave higher residuum contents than Wabumun coal. The reason for this is not clear. It may be speculated that the larger amount of decomposition or degradation observed in the low water content coals (Section 4.4.4) had created additional pores which required more residuum.

Residuum contents as a function of water content of all the coals studied in this program are plotted in Figure 5-6 for S1 (1/2" x 3/8") size fraction.

4.5 Product Qualities

Product quality data are shown in Tables 5-4 (proximate analysis, sulfur, calorific value) and 5-5 (ultimate analysis). These data are the average values of all the runs conducted for each size subseries. Individual quality parameters are further discussed below.

4.5.1 Water Content

All the products generated by this beneficiation method are practically water free, independent of coal quality, residuum quality, coal particle size, reaction temperature and residence time. Complete moisture removal from coal was confirmed by the amount of water recovered in each individual experiment.

The variations of residual moisture levels between the determinations by Gulf R&D and the sub-contractor laboratory (Appendix 1) can be attributed to moisture pick-up by the pulverized samples on route to the sub-contractor, despite the sealed nature of the container. Generally there is a time span of about two weeks between the two determinations.

4.5.2 Ash Content

Ash contents of products and raw coals are compared in Table 5-6. Unlike the water content, ash contents of products from all series are higher than the ash contents of their parent coals.

The increase of ash content depends on both water removal and residuum addition. While water removal increases ash content, residuum addition counterbalances these increases. Since replacement of water by residuum is less for large particle size, more increases in ash content are observed. The ratio of residuum content to water removal will determine the degree of increase in ash content.

Residuum quality also has a limited influence in ash content in the products because they can affect the residuum content of the product slightly. Temperature and residence time do not influence ash content of the product.

4.5.3 Volatile Matter Content

Table 5-7 compares volatile matter contents of products and their parent coals in each series. Substantial increases of volatile matter content are observed for high moisture coals.

For low moisture coals, only moderate to even no increase of volatile matter content were observed.

The lower increases of volatile matter content for low moisture coals, again, suggests that more decomposition or degradation has occurred, when they are treated under similar conditions. Since petroleum residua should enhance volatile matter content, the lower increases also suggest that some volatile and higher heat content components of coal were lost during the process.

Because volatile matter content increases are again related to original water content and amount of residuum content, they are dependent on coal quality and coal particle size. The effect of residuum quality, temperature and residence time are minor factors in this case.

The increase in volatile matter content in the products is an important feature of this beneficiation process. Increases in volatile matter may help to further lower the ignition and combustion temperatures of the already active low rank coals. Basic combustion evaluations are required to confirm these benefits.

4.5.4 Sulfur Content

Table 5-8 compares sulfur contents of products and their parent coals. As expected, sulfur content of products are all higher, because high sulfur residua were used as immersion media.

The sulfur contents of the products depend on quality of coal and coal particle size, and are directly related to residuum content and the sulfur level in the residuum. For example, when size fraction S3 (1/4" x 16 mesh) of the Poplar River coal was treated with DRB residuum (7% sulfur), the product shows a sulfur content of 2%; however, when size fraction S1 (1/2" x 3/8") of the Wabumun coal was processed with the thermally treated Edmonton residua, sulfur content of the final product was only 0.46%. In fact, all the products in the WE series have sulfur content within the sulfur emission limit (1.2 lbs SO_2/MMBTU).

Two important points are shown in this section. Firstly, sulfur specification on thermal coals can be met by products from this beneficiation processing using a residuum available from current operation (residuum derived from Edmonton VTB), and secondly, optimization of process variables to minimize residuum content will be required when a high sulfur containing residuum is used.

4.5.5 Calorific Values

Calorific values of products and parent coals are compared in Table 5-9. The following increases were observed: 40-50% for Poplar River lignite, 20-30% for Wabumun subbituminous coal, and less than 10% for Wapiti, Roselyn, and Coal Valley coals.

The increases of calorific values are due to water removal and enhancement of BTU values by petroleum residua. The increases, therefore, are related to original water content and final residuum content which increases as particle size decreases. The softening points of the heavy residua also will affect the calorific values of the products, because they can affect the draining rate of residuum from the coal product and hence the final residuum content.

A factor in the smaller increases in calorific values in low moisture coals might also be the loss of volatile components.

4.5.6 Elemental Composition

The elemental composition of the beneficiated products are compared with their parent coals in Table 5-5. As a result of dewatering, residuum addition, and decomposition possibly into liquid fuels, the composition of products are significantly different from their parent coals.

The products are significantly higher in carbon and hydrogen content than their parent coals. The H/C ratios are also higher. This is due to the addition of petroleum products. Nitrogen and sulfur contents are also higher for the same reason. While the water in the parent coals is greatly reduced, the ash content increases slightly.

The oxygen content of the products, when compared with the oxygen content of raw coal on a dry basis, shows that some oxygen removal has been achieved. Some of this oxygen removal is confirmed by the existence of carbon dioxide and carbon monoxide in the gas samples collected in the WD and PD series; others are believed to be oxygen containing species that were converted into liquid fuels which were mixed with the heavy residua.

The extent of oxygen reduction in the size fractions may also help to explain the magnitude of unaccounted materials reported in Table 5-3.

4.6 BTU Recoveries

BTU recoveries based on products and upgraded coals are reported in Table 5-10. While BTU recoveries based on product normally exceed 100% and increase as particle sizes decrease, low moisture coals again showed that they have the lowest BTU recoveries based on products, despite the fact that they have higher residuum content than the Wabumun coal. BTU recoveries based on upgraded coal usually decreased as particle size decreased and varied from 88-98% by Poplar River lignite, 87-100% for Wabumun coal, and about 80-90% for the two large size fractions of Wapiti, Coal Valley and Roselyn coals. BTU recoveries based on upgraded coals are shown in Figures 5-12 and 5-13.

It should also be pointed out when all the analytical data were checked by the program "Data Checking", Poplar River and Wabumun coal gave good correlation between BTU determined and BTU calculated after adjustment for ash content. Wapiti, Coal Valley and Roselyn, however, gave much larger discrepanices. This again suggests that high BTU content components were lost in coal decomposition for the low moisture coals.

TABLE 5-1

OVERVIEW OF THE EFFECT OF PROCESSING VARIABLES ON PRODUCT YIELD AND QUALITY

	Reaction Temp.	Residence Time	Coal	Residuum	Particle Size
Product Yield	X		XX	XX	XXX
Residuum Content	X		XX	XX	XXX
Water Recovered					
Gas Production					
Ash %			X	X	XX
VM%			X	X	XX
S %			X	XXX	XXX
C.V.			X	X	XX
BTU Recovery (on Upgraded Coal)?			X?	?	X?

XXX Large effect
XX Medium effect
X Small effect

TABLE 5-2

REACTION TEMPERATURES USED FOR THE BENEFICIATION EXPERIMENTS

Series	200°C	240°C	260°C	280°C	300°C	320°C
WD				X	X	X
WM		X		X		X
WE	X	X		X		
WE-A						
PD		X	X	X		
PM		X		X		X
PE	X	X		X		
TD		X		X		
RD		X		X		
CD		X		X		
TM		X		X		
RM		X		X		
CM		X		X		
TE		X		X		
RE		X		X		
CE		X		X		
TE-A		X		X		
RE-A		X		X		
CE-A		X		X		

TABLE 5-3

YIELD STRUCTURES OF BENEFICIATION EXPERIMENTS

Series	Size Fraction	(A) % Residuum	(C) % Water Recovered	(D) % Product Yield	(E)* % Calc. Product Yield	(F)** % Unaccounted	(G) % Yield Upgraded Coal	(B) Gas Vol (litr[illegible])
WD	S1	6.4	12.2	90.6	93.8	3.2	84.9	1.4
	S2	6.9	11.8	91.3	94.7	3.4	85.0	1.7
	S3	13.5	11.6	95.9	102.2	6.3	82.9	1.5
WM	S1	4.8	11.8	90.4	92.6	2.2	86.1	-
	S2	6.9	11.5	91.3	95.1	3.8	85.0	-
	S3	12.2	11.5	95.8	100.8	5.0	-	-
WE	S1	8.9	11.8	92.6	96.8	4.2	84.4	-
	S2	10.5	11.6	93.7	98.7	5.0	83.8	-
	S3	15.7	11.7	99.3	104.7	5.4	84.5	-
PD	S1	15.0	21.5	86.6	92.4	5.8	73.1	1.7
	S2	16.2	18.6	87.7	97.1	9.4	73.5	1.8
	S3	19.9	17.3	96.6	103.2	6.6	77.4	1.5
PM	S1	11.7	20.5	88.7	90.0	1.3	78.6	-
	S2	13.7	18.8	89.0	94.1	5.1	76.7	-
	S3	18.6	17.0	93.8	101.9	8.1	-	-
PE	S1	15.3	20.5	92.0	93.8	1.8	77.9	-
	S2	16.4	18.6	90.3	99.9	9.7	75.5	-
	S3	-	-	-	-	-	-	-

* $(E) = (100-C)\left(\frac{100}{100-A}\right)$

** $F = E-D$

TABLE 5-3 Continued

Series	Size Fraction	(A) % Residuum	(C) % Water Recovered	(D) % Product Yield	(E)* % Calc. Product Yield	(F)** % Unaccounted	(G) % Yield Upgraded Coal
TD	S1	8.5	5.5	96.2	103.3	7.1	87.9
	S2	7.1	4.9	97.3	102.4	5.1	90.4
TM***	S1	9.0	5.4	97.3	103.9	6.6	88.5
	S2	8.5	5.3	96.3	103.5	7.2	88.1
TE	S1	9.6	5.0	97.0	105.1	8.1	87.7
	S2	7.9	4.8	96.8	103.4	6.6	89.2
TE-A	S1	6.9	5.0	95.8	102.0	6.2	89.1
	S2	7.2	4.9	95.6	102.5	6.9	88.7
RD	S1	10.8	7.0	95.1	104.3	9.2	84.8
	S2	10.3	7.8	94.6	102.8	8.2	84.8
RM***	S1	8.2	6.5	94.3	101.8	7.5	86.6
	S2	8.4	7.4	93.4	101.1	7.7	85.5
RE	S1	7.5	7.8	94.8	99.7	4.9	87.7
	S2	7.2	8.1	95.0	99.0	4.0	88.2
RE-A	S1	7.6	7.1	92.8	100.5	7.7	85.8
	S2	8.4	7.8	94.0	100.6	6.6	86.1
CD	S1	9.4	6.2	96.3	103.5	7.2	87.2
	S2	8.5	5.9	95.3	102.8	7.5	87.2
CM***	S1	7.7	4.9	95.5	103.0	7.5	88.2
	S2	8.3	4.9	95.6	103.7	8.1	87.7
CE	S1	10.6	5.9	95.8	105.3	9.5	85.6
	S2	9.1	5.6	96.9	103.8	6.9	88.1
CE-A	S1	6.5	5.1	95.8	101.5	5.7	89.6
	S2	6.8	5.1	96.0	101.8	5.8	89.5

*** 30 min. draining time

TABLE 5-4

PRODUCT QUALITIES
(PROXIMATE, S, CALORIFIC VALUE)

Series	Size Fraction	H_2O %	Ash %	VM %	S %	CV (BTU/lb)
WD	S1	-	20.7	33.9	0.70	10,127
	S2	-	21.3	32.8	0.76	9,957
	S3	-	23.0	35.2	0.97	10,115
WM	S1	-	20.5	33.1	0.65	10,012
	S2	-	21.3	33.3	0.70	9,969
	S3	-	23.0	34.7	1.04	10,027
WE	S1	-	20.0	35.8	0.46	10,370
	S2	-	20.7	35.4	0.47	10,295
	S3	-	22.0	39.1	0.60	10,381
PD	S1	-	18.0	41.0	1.54	10,265
	S2	-	19.8	40.0	1.68	10,119
	S3	-	21.1	40.6	2.00	10,025
PM	S1	1.23	17.5	41.5	1.25	9,980
	S2	1.41	19.5	40.9	1.30	9,998
	S3	1.56	21.6	41.0	1.58	10,060
PE	S1	-	16.9	43.3	0.90	10,332
	S2	-	19.2	42.2	0.99	10,226
	S3					

TABLE 5-4 Continued

Series	Size Fraction	H_2O %	Ash %	VM %	S %	CV (BTU/lb)
TD	S1	-	33.1	27.5	-	8,733
	S2	-	32.5	29.1	-	8,773
TM***	S1	-	32.71	28.5	0.89	8,804
	S2	-	32.67	28.3	0.91	8,758
TE	S1	-	32.8	28.8	-	8,503
	S2	-	32.7	28.8	-	8,616
TE-A	S1	-	33.21	28.4	-	8,609
	S2	-	33.06	29.3	-	8,461
RD	S1	-	10.7	39.1	-	10,958
	S2	-	9.94	39.3	-	10,951
RM***	S1	-	10.82	39.7	1.16	11,155
	S2	-	10.06	39.9	1.16	11,152
RE	S1	-	10.76	39.3	-	10,923
	S2	-	9.90	40.0	-	10,985
RE-A	S1	-	10.98	40.5	-	10,919
	S2	-	10.00	40.8	-	11,006
CD	S1	-	11.11	35.4	-	12,226
	S2	-	11.20	36.6	-	11,994
CM***	S1	-	11.20	36.4	0.61	12,147
	S2	-	11.20	35.8	0.72	12,154
CE	S1	-	11.2	36.2	-	12,224
	S2	-	11.04	36.7	-	12,247
CE-A	S1	-	11.16	36.50	-	11,975
	S2	-	11.15	36.2	-	11,957

*** 30 min. draining time

TABLE 5-5

PRODUCT QUALITIES
(ULTIMATE ANALYSIS)

Series	Size Fraction	% C	% H	% N	% S	% O*	% Ash	% H_2O
WD	S1	58.9	3.8	0.6	0.7	14.5	20.4	1.1
	S2	58.9	3.6	0.6	0.7	14.1	21.1	1.0
	S3	57.3	3.9	0.6	1.0	13.4	23.1	0.9
WM	S1	58.9	3.8	0.7	0.6	14.2	20.5	1.3
	S2	57.5	3.8	0.7	0.6	14.4	21.6	1.4
	S3	56.8	4.1	0.7	1.0	12.4	23.6	1.4
WE	S1	61.7	3.8	0.6	0.46	13.44	20.0	(Dry basis)
	S2	59.8	3.8	0.7	0.5	14.6	20.6	
	S3	60.0	4.5	0.7	0.7	12.8	21.3	
PD	S1	60.5	4.0	0.7	1.6	14.4	18.1	0.7
	S2	59.5	4.0	0.7	1.8	13.8	19.4	0.8
	S3	59.1	4.0	0.7	2.0	12.2	21.3	0.7
PM	S1	59.98	4.16	0.76	1.27	14.79	17.43	1.61
	S2	58.76	3.99	0.74	1.30	13.91	19.60	1.70
	S3	58.58	4.04	0.74	1.47	12.22	21.49	1.46
PE	S1							
	S2							
	S3							
Parent Coal								
W	S1	51.5	2.9	0.6	0.3	14.0(15.9)**	18.5	12.2
	S2	49.4	2.9	0.6	0.3	15.3(17.4)**	19.4	12.1
	S3	46.3	2.3	0.5	0.3	16.9(19.1)**	22.0	11.7
P	S1	44.9	2.2	0.5	0.6	15.1(19.1)**	15.6	21.1
	S2	44.0	2.4	0.5	0.7	15.6(19.4)**	17.3	19.5
	S3	45.0	2.3	0.5	0.7	13.4(16.3)**	20.3	17.8

* By difference

** Dry basis

TABLE 5-6

COMPARISONS OF ASH CONTENTS OF PRODUCTS AND RAW COALS

Series	Size Fraction	Ash % of Raw Coal	Ash % Product	% Increase
	S1	18.5	20.7	11.9
WD	S2	19.4	21.3	9.8
	S3	22.0	23.0	4.5
	S1	18.5	20.5	10.6
WM	S2	19.4	21.3	9.8
	S3	22.0	22.0	0.0
	S1	18.5	20.0	8.0
WE	S2	19.4	20.7	6.7
	S3	22.0	22.0	0.0
	S1	15.6	18.0	15.4
PD	S2	17.3	19.8	14.4
	S3	20.3	21.1	3.9
	S1	15.6	17.5	12.2
PM	S2	17.3	19.5	12.7
	S3	20.3	21.6	6.4
	S1	15.6	16.9	8.3
PE	S2	17.3	19.2	10.9
	S3	20.3	-	-

TABLE 5-6 Continued

Series	Size Fraction	Ash % of Raw Coal	Ash % Product	% Increase
TD	S1	31.8	33.1	4.1
	S2	31.6	32.5	2.8
TM***	S1	31.8	32.7	2.8
	S2	31.6	32.7	3.5
TE	S1	31.8	32.8	3.1
	S2	31.6	32.7	3.5
TE-A	S1	31.8	32.2	1.3
	S2	31.6	33.1	4.7
RD	S1	10.2	10.7	4.9
	S2	9.4	9.9	5.3
RM***	S1	10.2	10.8	5.9
	S2	9.4	10.1	7.4
RE	S1	10.2	10.8	5.9
	S2	9.4	9.9	5.3
RE-A	S1	10.2	10.9	6.8
	S2	9.4	10.0	6.4
CD	S1	10.7	11.1	3.7
	S2	10.7	11.2	4.6
CM***	S1	10.7	11.2	4.6
	S2	10.7	11.2	4.6
CE	S1	10.7	11.2	4.6
	S2	10.7	11.1	3.7
CE-A	S1	10.7	11.6	8.4
	S2	10.7	11.2	4.7

*** 30 min. draining time

TABLE 5-7

COMPARISONS OF VOLATILE MATTER CONTENT OF PRODUCTS AND RAW COALS

Series	Size Fraction	VM % of Raw Coal	VM % Product	% Increase	% Inc. Due to Drying	% Inc. due to Residuum Addition
	S1	28.9	33.9	17.3	13.9	3.4
WD	S2	28.4	32.8	15.5	13.8	1.7
	S3	27.2	35.2	29.4	13.3	2.2
	S1	28.9	33.1	14.6	13.9	0.7
WM	S2	28.4	33.3	17.2	13.8	3.4
	S3	27.2	34.7	27.6	13.3	0.4
	S1	28.9	35.8	23.8	13.9	9.9
WE	S2	28.4	35.4	24.6	13.8	10.8
	S3	27.2	39.1	43.7	13.3	30.4
	S1	30.8	41.0	33.1	26.7	6.4
PD	S2	30.5	40.0	31.1	24.2	6.9
	S3	31.4	40.6	29.3	21.5	7.8
	S1	30.8	41.4	34.4	26.7	7.7
PM	S2	30.5	40.9	34.0	24.2	9.8
	S3	31.4	41.0	30.6	21.5	9.1
	S1	30.8	43.3	40.6	26.7	13.9
PE	S2	30.5	42.2	38.4	24.2	14.2
	S3	31.4	-	-	21.5	-

TABLE 5-7 Continued

Series	Size Fraction	VM % of Raw Coal	VM % Product	% Increase	% Inc. Due to Drying	% Inc. due to Residuum Addition
TD	S1	25.8	27.5	6.6	5.5	1.1
	S2	26.5	29.1	9.8	5.5	4.3
** TM	S1	25.8	28.5	10.5	5.5	5.0
	S2	26.5	28.3	6.8	5.5	1.3
TE	S1	25.8	28.8	11.6	5.5	6.1
	S2	26.5	28.8	8.7	5.5	3.2
TE-A	S1	25.8	28.4	10.0	5.5	4.5
	S2	26.5	29.3	10.6	5.5	5.1
RD	S1	35.6	39.1	9.8	7.5	2.3
	S2	35.9	39.3	9.5	7.5	2.0
** RM	S1	35.6	39.7	11.5	7.5	4.0
	S2	35.9	39.7	11.1	7.5	3.6
RD	S1	35.6	39.3	10.4	7.5	2.9
	S2	35.9	40.0	11.4	7.5	3.9
RE-A	S1	35.6	40.5	13.8	7.5	6.3
	S2	35.9	40.8	13.6	7.5	6.1
CD	S1	35.3	35.4	0.3	5.5	-5.2
	S2	33.8	36.6	8.3	5.5	2.8
** CM	S1	35.3	36.4	1.1	5.5	-4.4
	S2	33.8	35.8	5.9	5.5	+0.4
CE	S1	35.3	36.2	2.5	5.5	-3.0
	S2	33.8	36.7	18.6	5.5	3.1
CE-A	S1	35.3	36.5	3.4	5.5	-2.3
	S2	33.8	36.2	7.1	5.5	+1.6

** 30 minute draining time

TABLE 5-8

COMPARISONS OF SULFUR CONTENTS OF PRODUCTS AND RAW COALS

Series	Size Fraction	S % of Raw Coal	S % Product	% Increase
WD	S1	0.30	0.70	113
	S2	0.30	0.76	153
	S3	0.32	0.97	203
WM	S1	0.30	0.65	116
	S2	0.30	0.70	133
	S3	0.32	1.04	225
WE	S1	0.30	0.46	53
	S2	0.30	0.47	56
	S3	0.32	0.60	88
PD	S1	0.55	1.54	180
	S2	0.65	1.68	158
	S3	0.73	2.00	174
PM	S1	0.55	1.25	127
	S2	0.65	1.30	100
	S3	0.73	1.58	116
PE	S1	0.55	0.90	63
	S2	0.65	0.99	52
	S3	0.73	-	-

TABLE 5-8 Continued

Series	Size Fraction	VM % of Raw Coal	VM % Product	% Increase
TD	S1			
	S2			
** TM	S1	0.40	0.89	122
	S2	0.41	0.91	122
TE	S1			
	S2			
TE-A	S1			
	S2			
RD	S1			
	S2			
** RM	S1	0.62	1.16	87
	S2	0.63	1.16	84
RE	S1			
	S2			
RE-A	S1			
	S2			
CD	S1			
	S2			
** CM	S1	0.32	0.61	91
	S2	0.31	0.72	132
CE	S1			
	S2			
CE-A	S1			
	S2			

** 30 minute draining time

TABLE 5-9

COMPARISONS OF BTU VALUES OR PRODUCTS AND RAW COALS

Series	Size Fraction	C.V. of Raw Coal	C.V. of Product	Increase in C.V.	% Increase in C.V.	% Inc. Due to Drying	% Inc. Due to Residuum Addition
	S1	8,463	10,127	1,664	19.7	13.9	5.8
WD	S2	8,272	9,957	1,685	20.4	13.8	6.6
	S3	7,939	10,115	2,176	27.4	13.3	14.2
	S1	8,463	10,012	1,549	18.3	13.9	4.4
WM	S2	8,272	9,969	1,697	20.5	13.8	6.7
	S3	7,939	10,027	2,088	26.3	13.3	13.0
	S1	8,463	10,370	1,907	22.5	13.9	8.6
WE	S2	8,272	10,295	2,023	24.5	13.8	10.7
	S3	7,939	10,381	2,442	30.8	13.3	17.5
	S1	7,079	10,265	3,186	45.0	26.7	18.3
PD	S2	7,029	10,119	3,000	44.0	24.2	19.8
	S3	6,764	10,025	3,261	48.2	21.5	26.7
	S1	7,079	9,980	2,901	40.9	26.7	14.3
PM	S2	7,029	9,998	2,969	42.2	24.2	18.0
	S3	6,764	10,060	3,296	48.7	21.5	27.2
	S1	7,079	10,332	3,253	45.9	26.7	19.2
PE	S2	7,029	10,226	3,197	45.5	24.2	21.3
	S3	6,764	-	-	-	-	-

TABLE 5-9 Continued

Series	Size Fraction	C.V. of Raw Coal	C.V. of Product	Increase in C.V.	% Increase in C.V.	% Inc. Due to Drying	% Inc. Due to Residuum Addition
TD	S1	8,026	8,733	707	8.5	5.5	3.3
	S2	8,152	8,773	621	7.6	5.5	2.1
** TM	S1	8,026	8,804	778	9.7	5.5	4.2
	S2	8,152	8,758	606	7.4	5.5	1.9
TE	S1	8,026	8,503	477	5.9	5.5	0.4
	S2	8,152	8,616	462	5.7	5.5	0.2
TE-A	S1	8,026	8,609	583	7.3	5.5	1.8
	S2	8,152	8,461	309	3.8	5.5	-1.7
RD	S1	10,071	10,958	887	8.8	7.5	1.3
	S2	10,125	10,951	826	8.2	7.5	0.7
** RM	S1	10,071	11,155	1084	10.8	7.5	3.3
	S2	10,125	11,152	1027	10.1	7.5	2.6
RE	S1	10,071	10,923	852	8.5	7.5	1.0
	S2	10,125	10,985	860	8.5	7.5	1.0
RE-A	S1	10,071	10,919	848	8.4	7.5	0.9
	S2	10,125	11,006	881	8.7	7.5	1.2
CD	S1	11,500	12,226	726	6.3	5.5	0.8
	S2	11,487	11,994	507	4.4	5.5	-1.1
** CM	S1	11,500	12,147	647	5.6	5.5	0.1
	S2	11,487	12,154	667	5.8	5.5	0.3
CE	S1	11,500	12,224	724	6.3	5 .5	0.8
	S2	11,487	12,247	760	6.6	5.5	1.1
CE-A	S1	11,500	11,975	475	4.1	5.5	-1.4
	S2	11,487	11,957	470	4.1	5.5	-1.4

** 30 minute draining time

TABLE 5-10

BTU RECOVERIES

Series	Size Fraction	BTU Recovery based on Product (%)	BTU Recovery based on Upgraded Coal
WD	S1	107.9	95.9
	S2	110.7	97.5
	S3	121.4	92.3
WM	S1	106.7	97.6
	S2	109.9	96.6
	S3	120.1	93.8
WE	S1	109.2	91.2
	S2	111.4	90.0
	S3	125.0	88.4
PD	S1	125.6	92.8
	S2	126.3	90.8
	S3	142.2	93.1
PM	S1	128.4	101.6
	S2	127.5	96.9
	S3	139.8	94.6
PE	S1	130.6	93.9
	S2	125.0	86.8
	S3	-	-

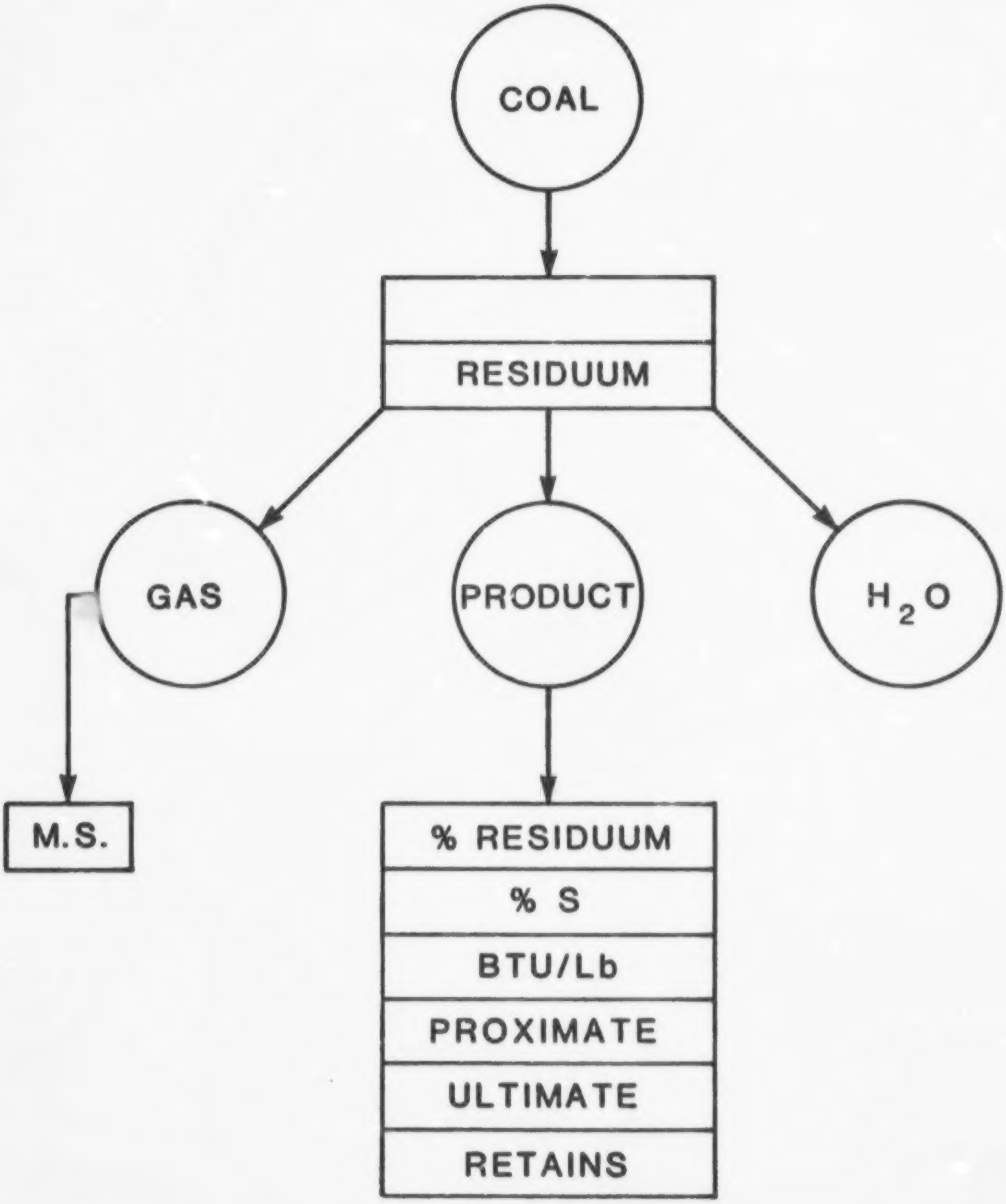
TABLE 5-10 Continued

Series	Size Fraction	BTU Recovery based on Product (%)	BTU Recovery based on Upgraded Coal
TD	S1	104.6	87.2
	S2	104.7	89.2
** TM	S1	106.7	87.7
	S2	103.5	85.8
TE	S1	102.8	81.2
	S2	102.2	85.4
TE-A	S1	102.7	88.1
	S2	99.2	83.9
RD	S1	103.4	85.5
	S2	102.3	85.4
** RM	S1	104.4	90.8
	S2	102.9	89.1
RE	S1	102.8	90.3
	S2	103.0	90.9
RE-A	S1	100.7	87.5
	S2	102.2	88.0
CD	S1	102.4	88.6
	S2	99.4	87.4
** CM	S1	100.9	89.8
	S2	101.2	89.2
CE	S1	101.8	86.0
	S2	103.3	89.6
CE-A	S1	99.8	90.3
	S2	99.9	89.8

** 30 minute draining time

FIGURE 5.1

FLOW DIAGRAM OF BENEFICIATION EXPERIMENTS


COAL
RESIDUUM
GAS
PRODUCT
H2O
M.S.
% RESIDUUM
% S
BTU/Lb
PROXIMATE
ULTIMATE
RETAINS

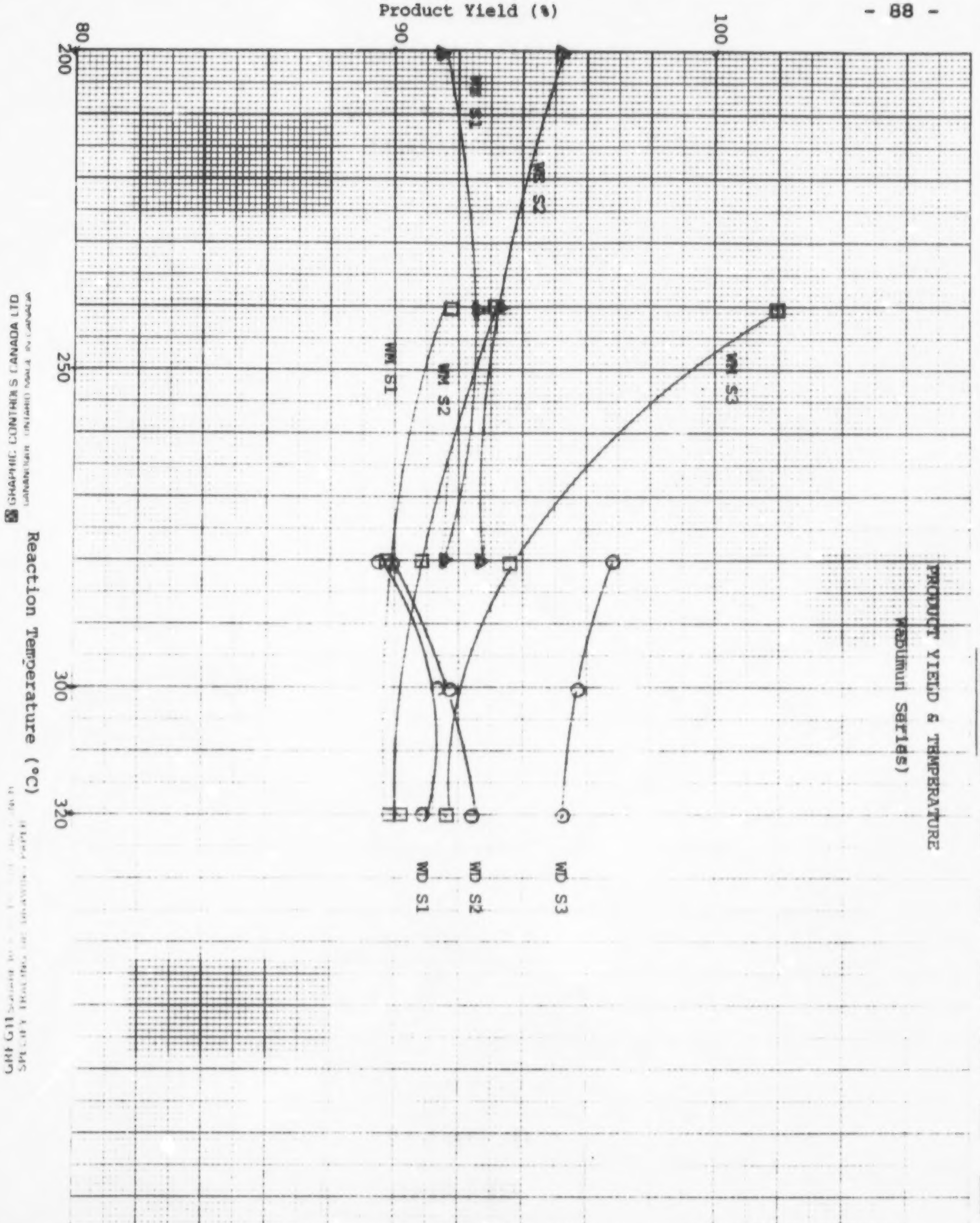


FIGURE 5-

PRODUCT YIELD & TEMPERATURE

(Wabumun Series)

FIGURE 5-3

PRODUCT YIELD & TEMPERATURE
(Poplar River Series)

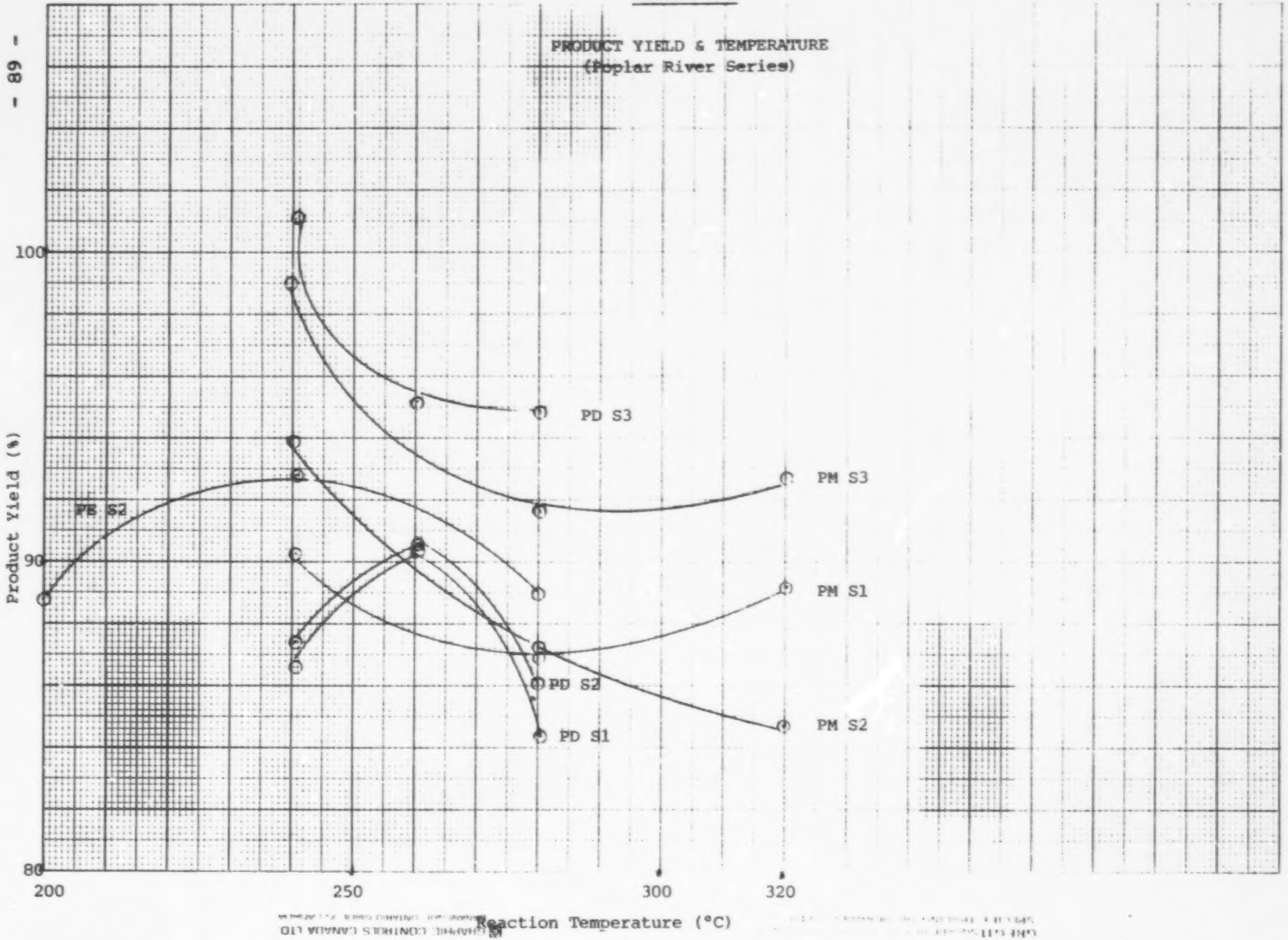
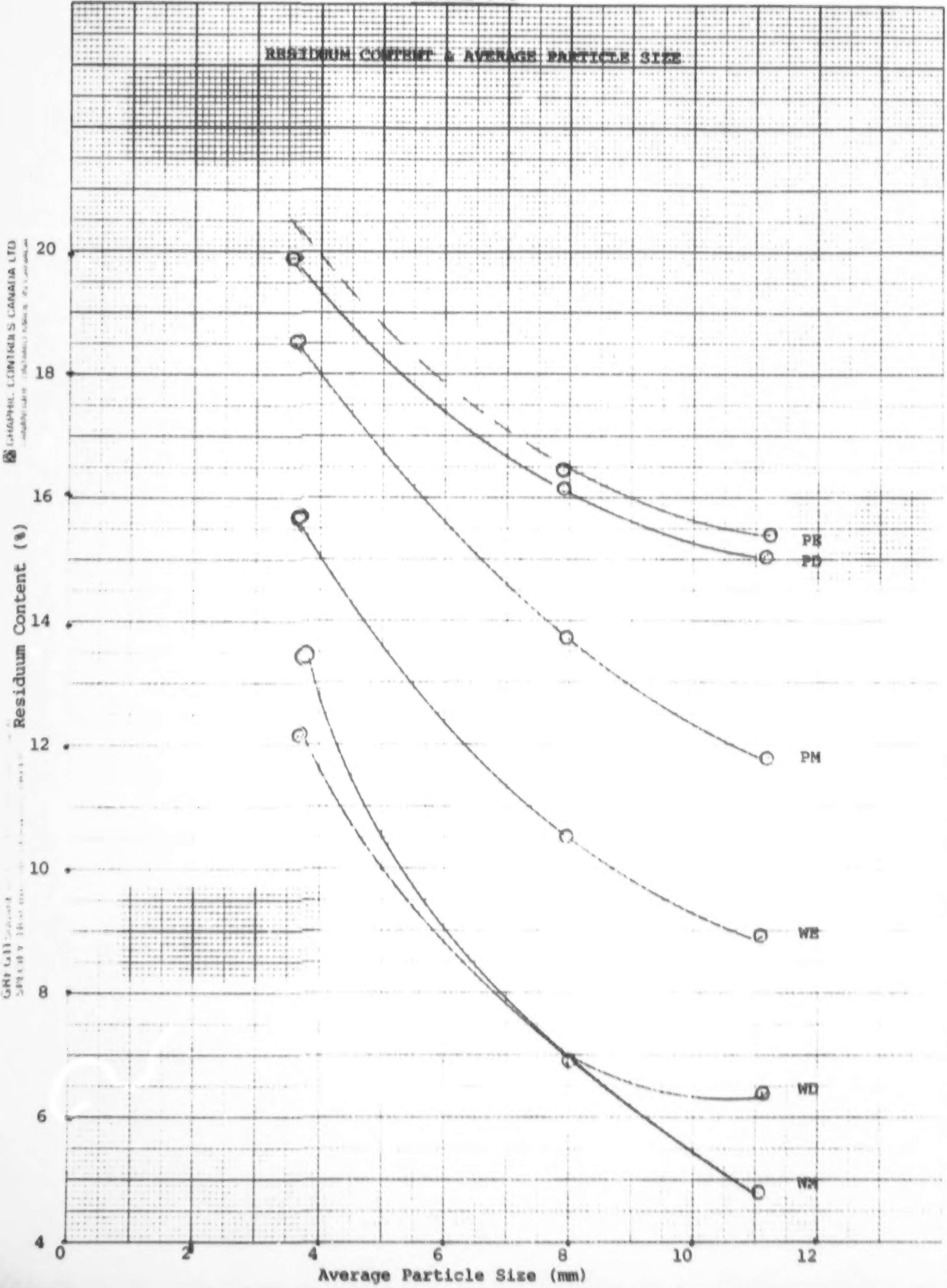


FIGURE 5-4


RESIDUUM CONTENT & AVERAGE PARTICLE SIZE
Residuum Content (%)
Average Particle Size (mm)
4
6
8
10
12
14
16
18
20
0
2
4
6
8
10
12
PE
PD
PM
WE
WD
WM

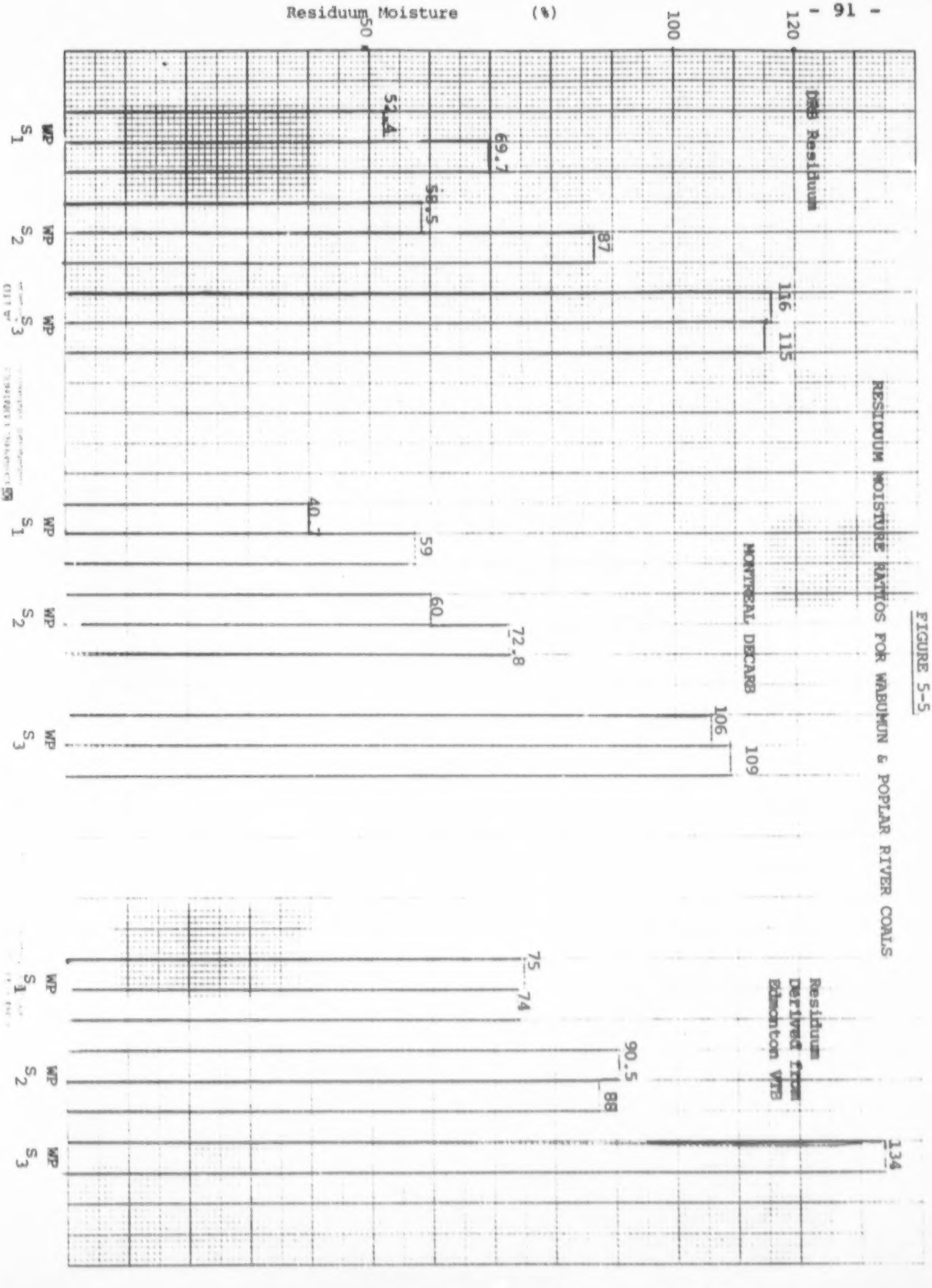
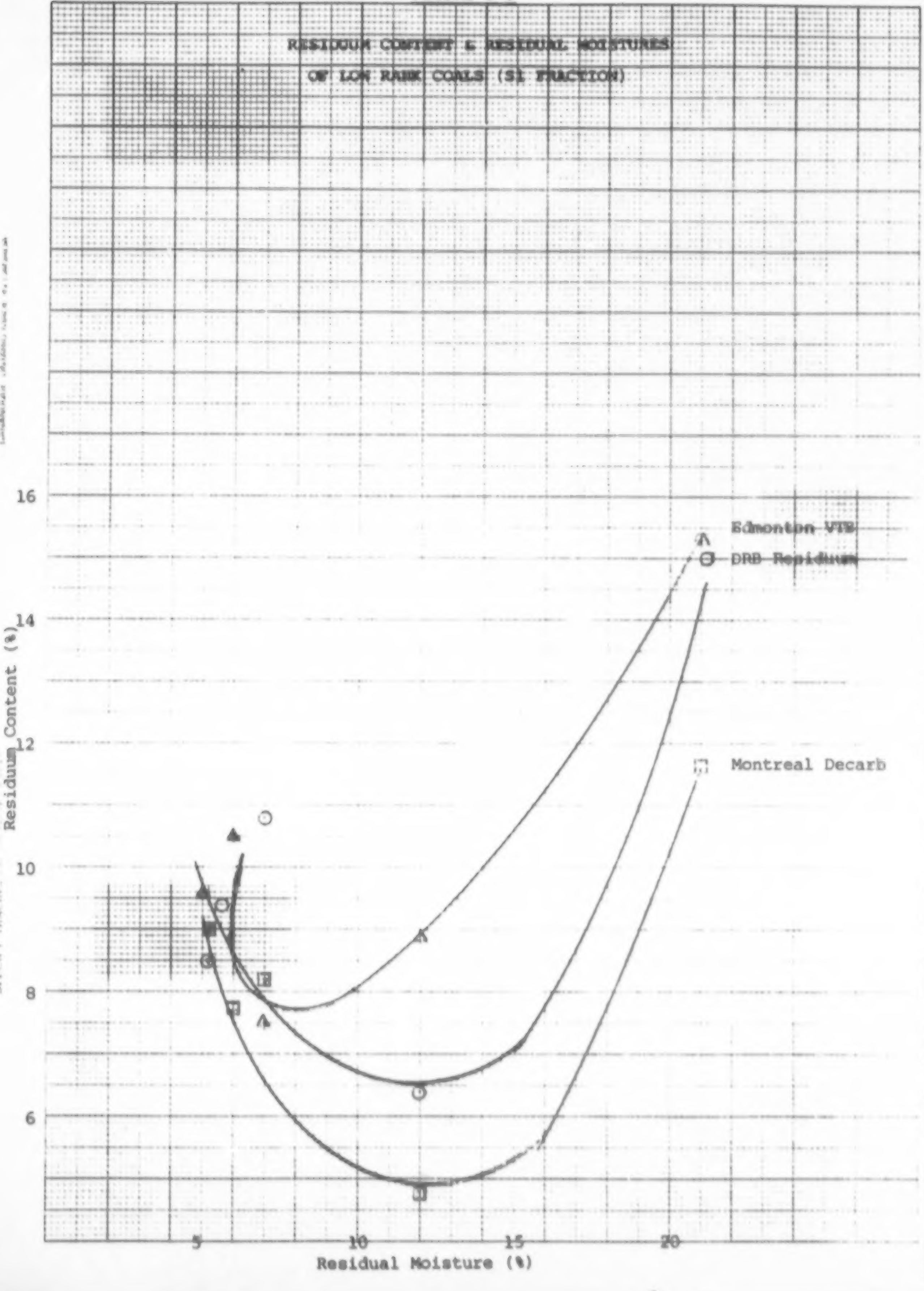


FIGURE 5-5

RESIDUUM MOISTURE RATIOS FOR WABUMUN & POPLAR RIVER COALS

FIGURE 5-6



RESIDUUM CONTENT & RESIDUAL MOISTURES OF LOW RANK COALS (S1 FRACTION)

FIGURE 5-7

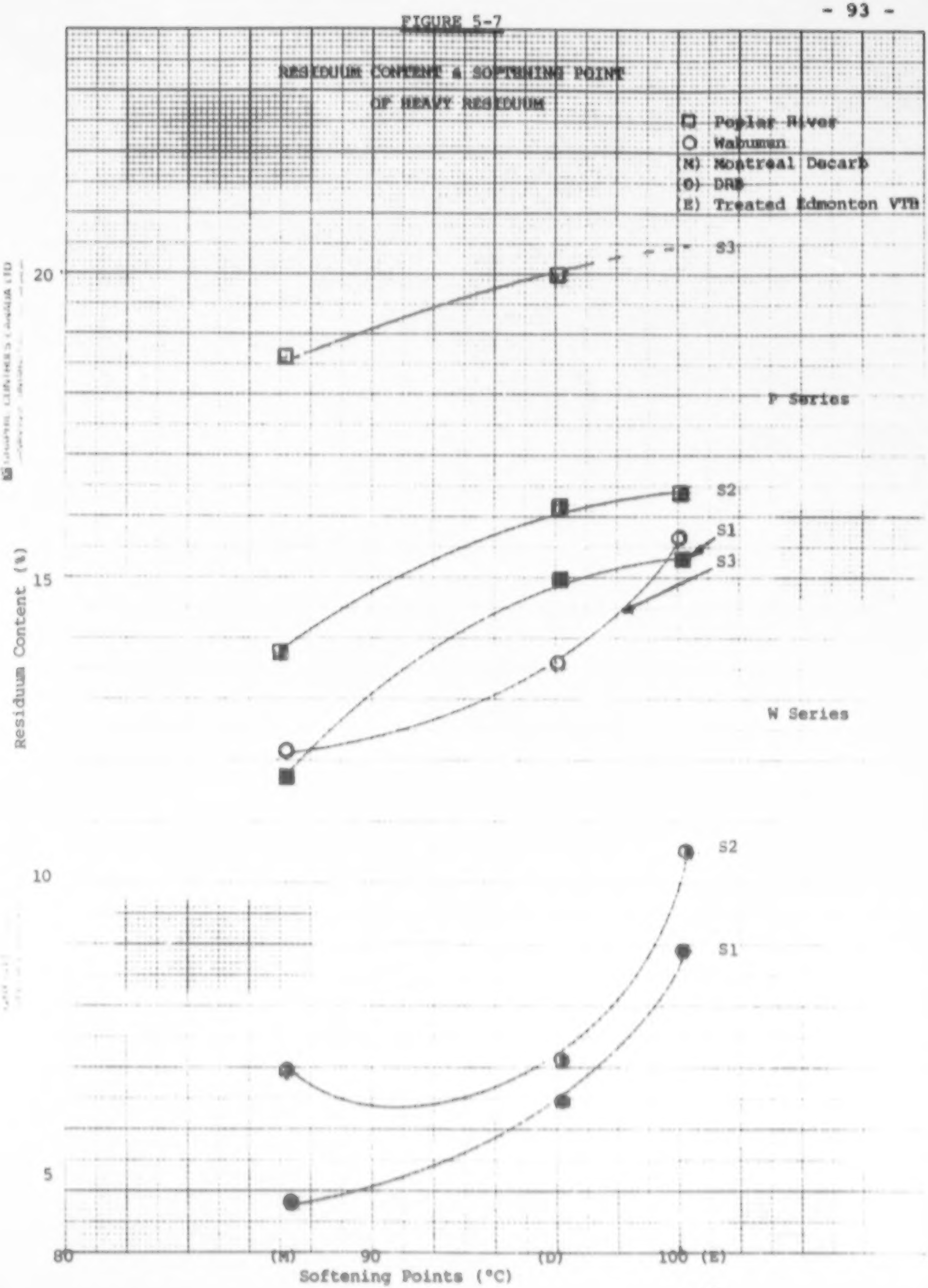

RESIDUUM CONTENT & SOFTENING POINT
OF HEAVY RESIDUUM
□ Poplar River
○ Wabumun
(M) Montreal Decarb
(D) DRB
(E) Treated Edmonton VTB
S3
P Series
S2
S1
S3
W Series
S2
S1
20
15
10
5
Residuum Content (%)
80
(M)
90
(D)
100
(E)
Softening Points (°C)

FIGURE 5-8

GAS COMPOSITIONS & RESIDENCE TIME

(WD SERIES)

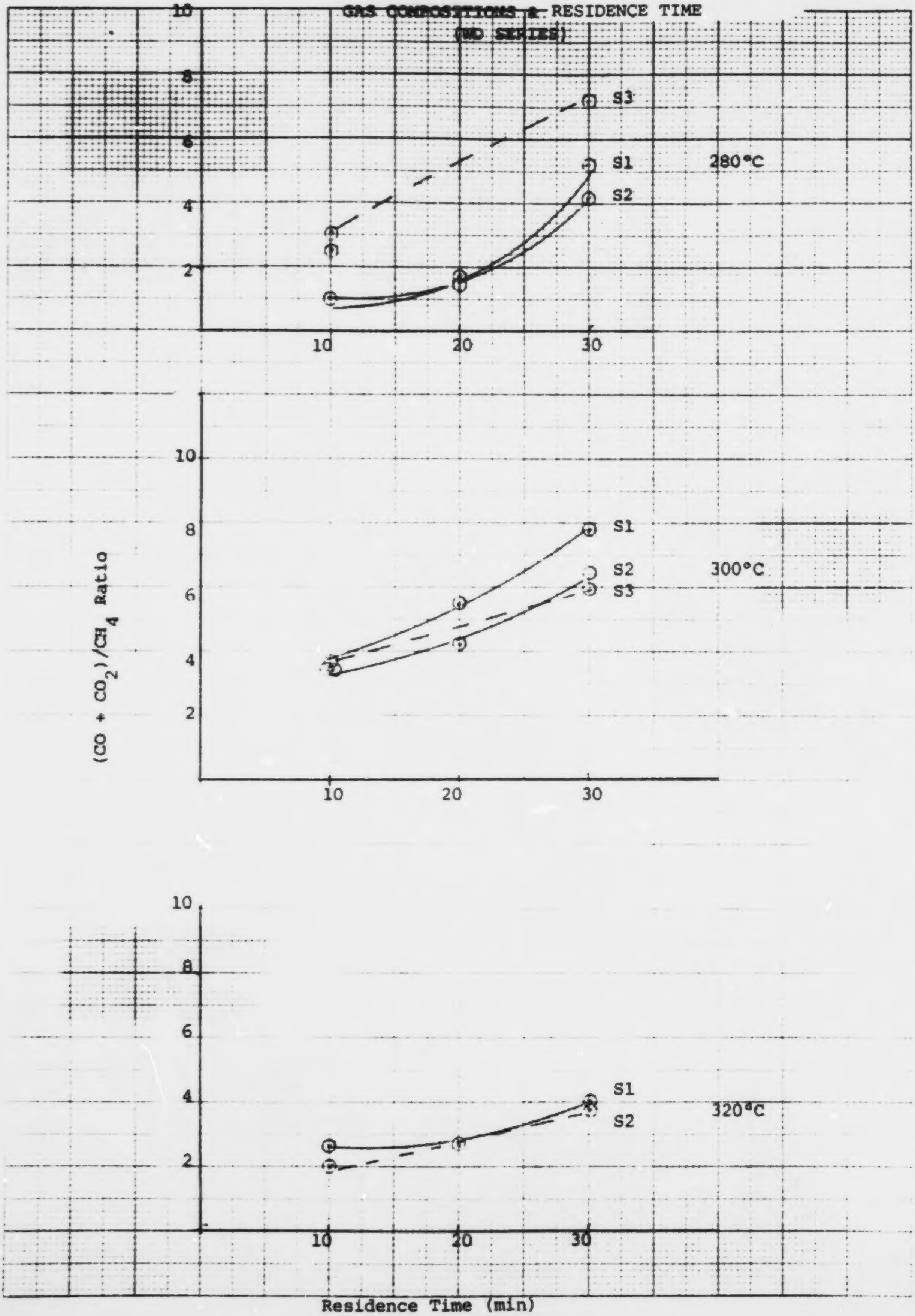
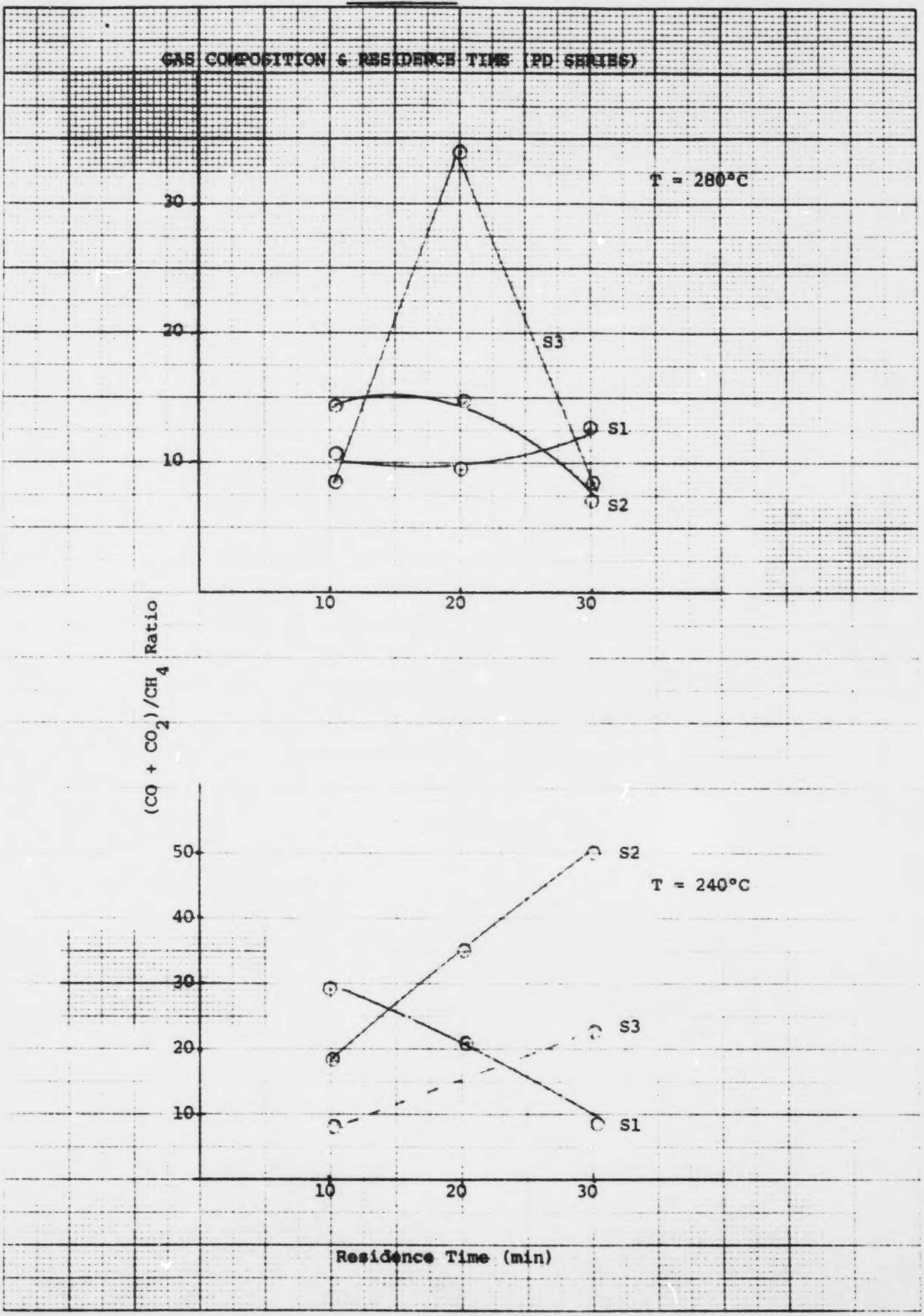
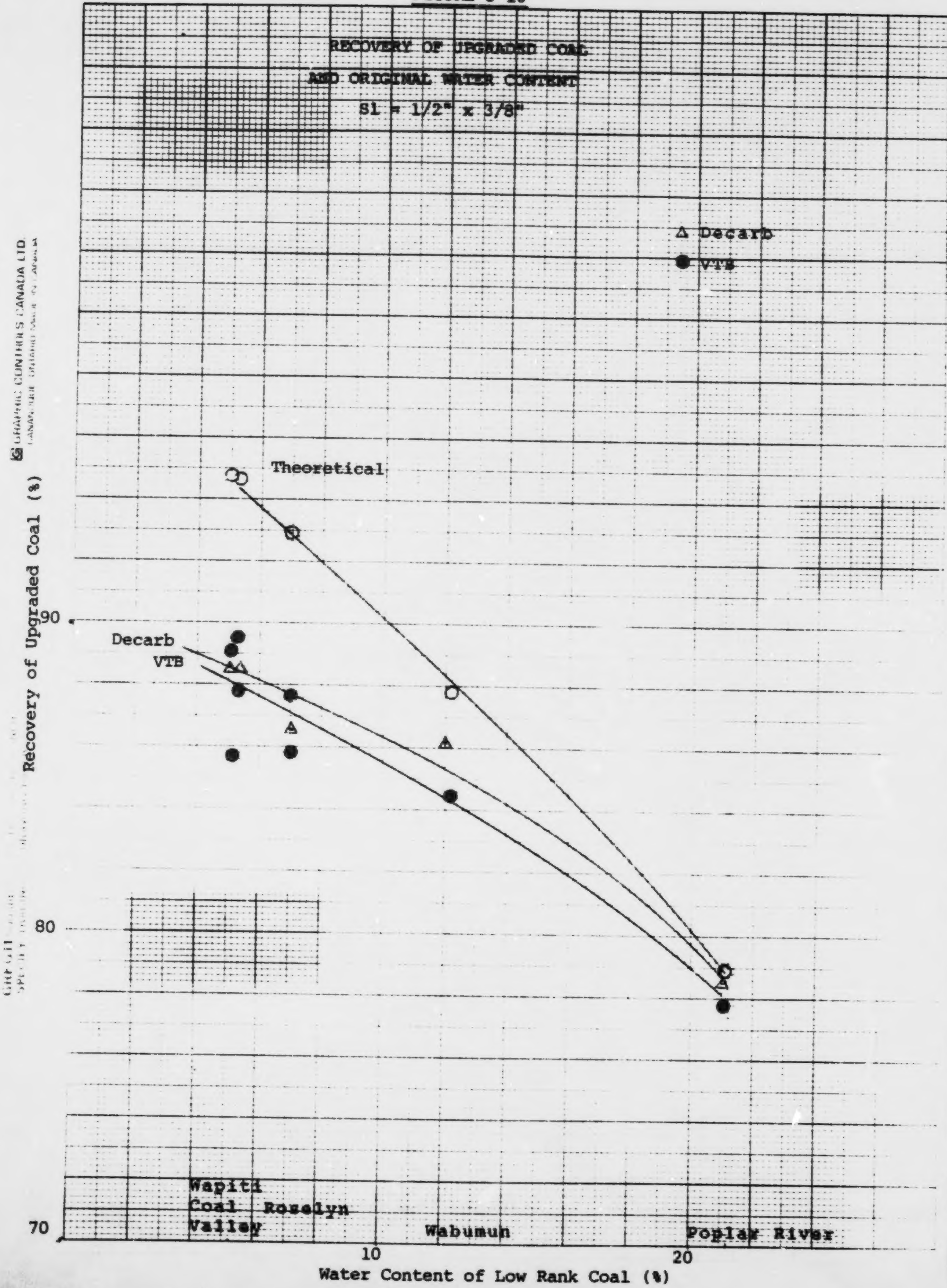


FIGURE 5-9



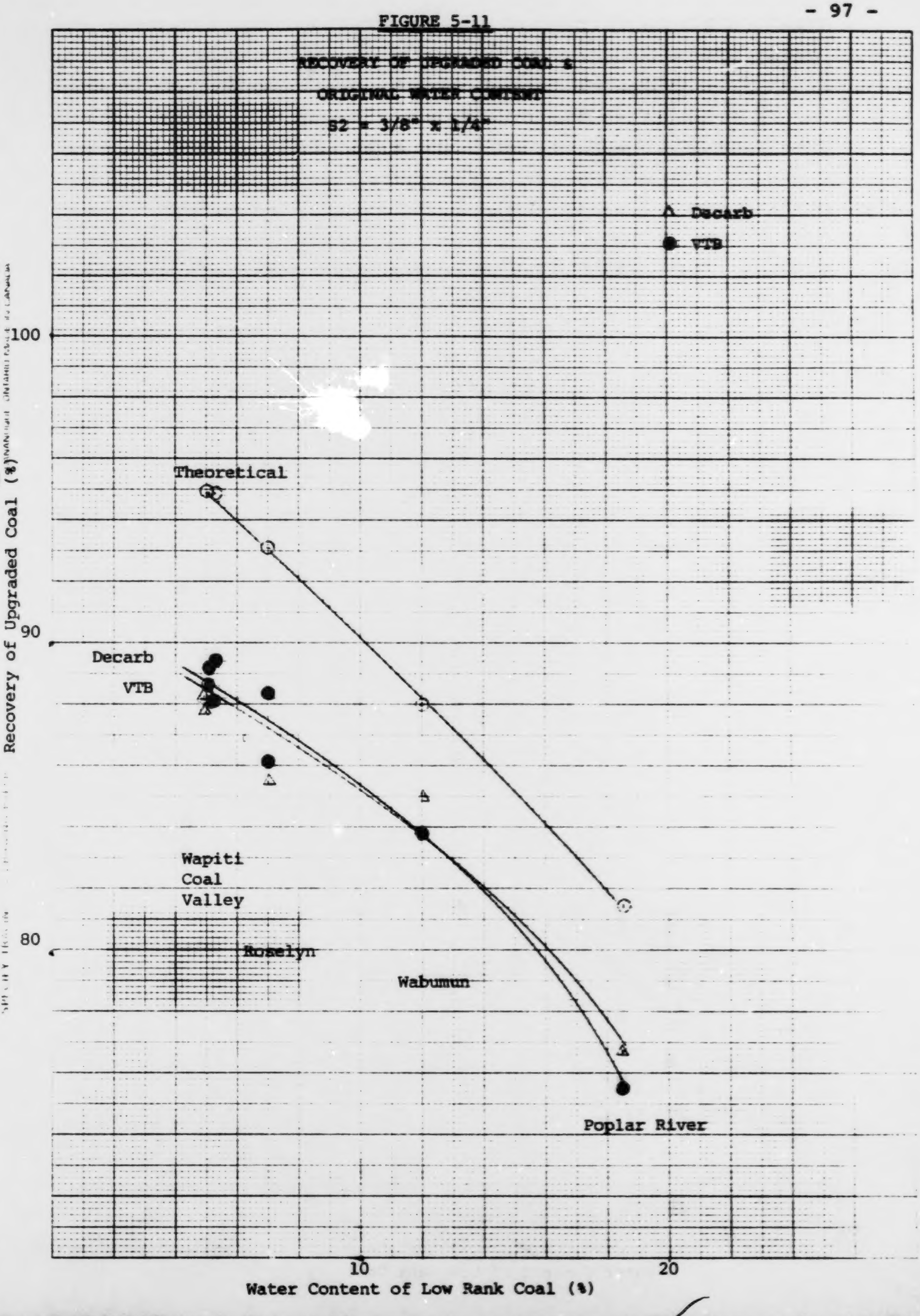
GAS COMPOSITION & RESIDENCE TIME (PD SERIES)

FIGURE 5-10



GRAPHIC CONTROLS CANADA LTD

FIGURE 5-11



GRAPHIC CONTROLS CANADA LTD

FIGURE 5-12

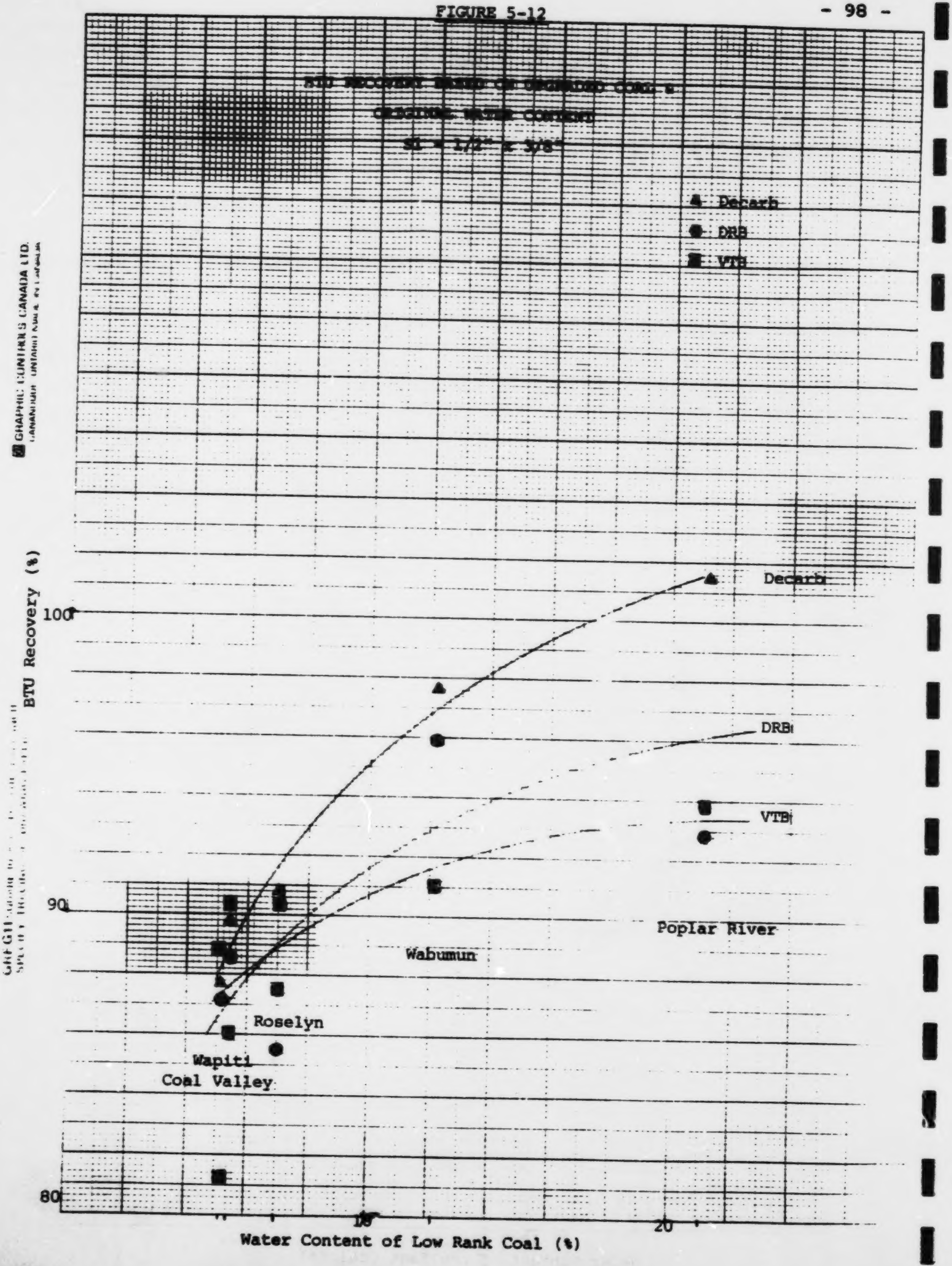
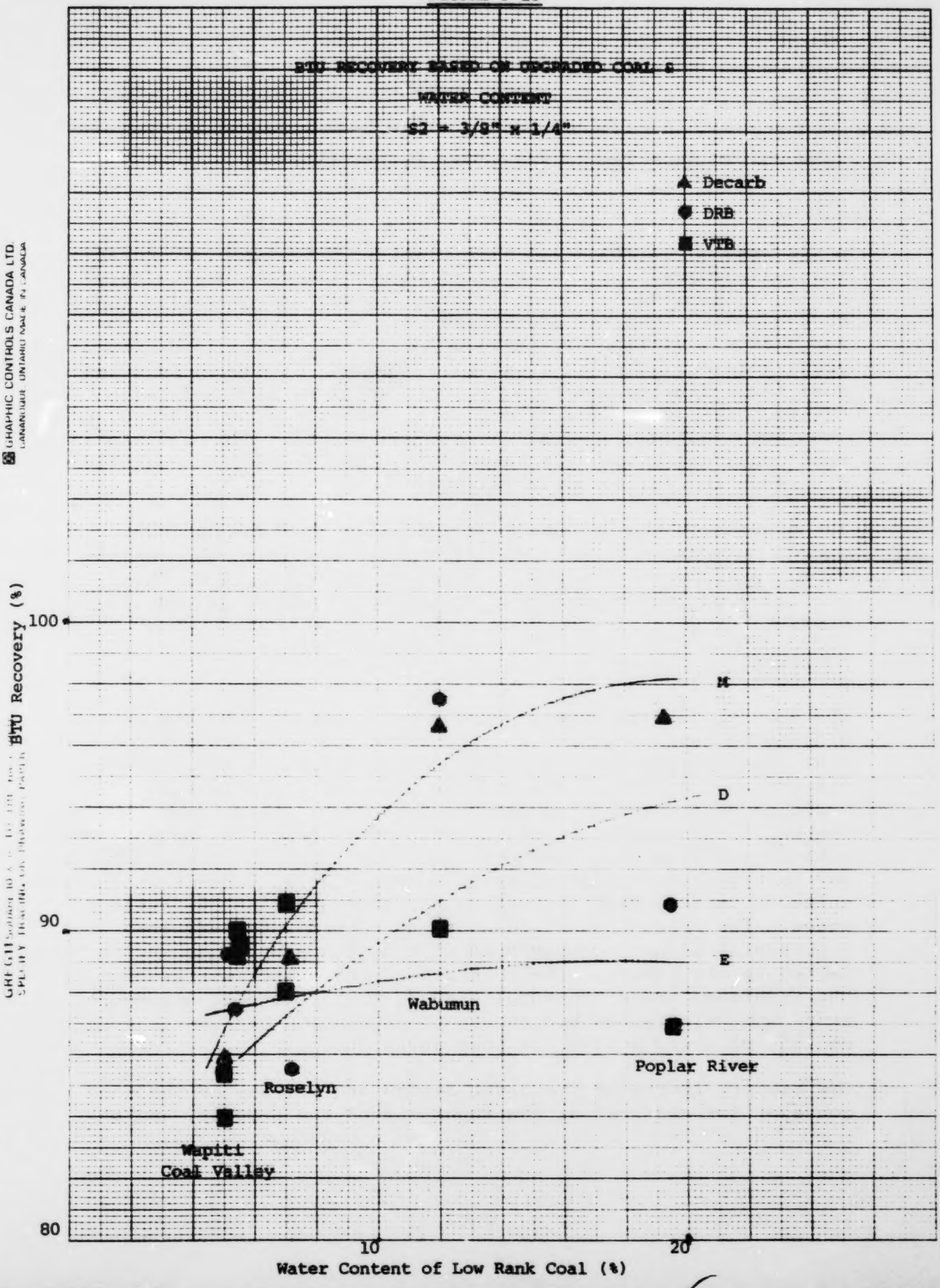

BTU RECOVERY BASED ON UPGRADED COAL & ORIGINAL WATER CONTENT
SI = 1/2" x 3/8"
▲ Decarb
● DRB
■ VTB
BTU Recovery (%)
100
90
80
Decarb
DRB
VTB
Poplar River
Wabumun
Roselyn
Wapiti
Coal Valley
10
20
Water Content of Low Rank Coal (%)

FIGURE 5-13



GRAPHIC CONTROLS CANADA LTD.
GANANOQUE ONTARIO MADE IN CANADA

TASK REPORT #6 - PRELIMINARY COST ESTIMATES

SUMMARY

A conceptual coal beneficiation plant (500 tonnes/hour) based on the Gulf process has been studied to provide some preliminary order of magnitude estimates of the capital and operating costs of such a plant. Capital costs have been estimated to be in the range $20-30 million depending on plant sophistication. Operating costs were estimated at about $1.90/tonne. It should be noted that these figures are based on data obtained from our batch system. Clearly it will be possible to obtain more detailed and meaningful estimates after the process has been demonstrated in a continuous operation. Because of the limitations, the accuracy of the range in capital costs is ±50%.

The studies on the process have indicated that the optimum operating mode will be dependent on each specific application. It will therefore only be possible to draw conclusions on the viability of the process by studying each case on an individual basis.

CONCEPTUAL DESIGN

The amount of surface water on the raw coal (at 10%) may be too high to be removed in the pitch coating process because of potential foaming problems. A provision has been made therefore to pre-dry the raw coal. The off-gas from the pitch coating step could be of environmental concern because of the hydrogen sulfide content. Interpretation of Alberta Energy Resources Control Board rulings and licensing indicates that incineration of the off-gas may be required to meet acceptable ground level concentrations for sulphur. Energy requirements were adjusted to include these items. The production of low quality by-product steam (from the driers etc) is not recovered in this design and is assumed to be vented in all cases. Site location of the plant away from major thoroughfares and urban population is therefore also assumed. Since most mine sites are remote to population centres, the venting of steam should not pose any problems.

The battery limits of the plant design are pre-set as the feed conveyor for raw coal at the input end of the process, and a

FIGURE 1 PROCESS INTERFACE WITH COAL OPERATION

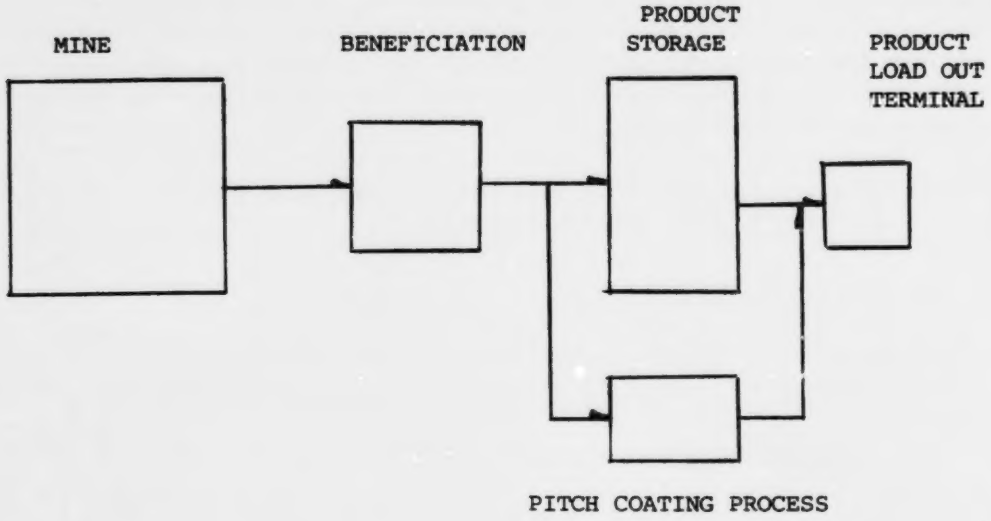
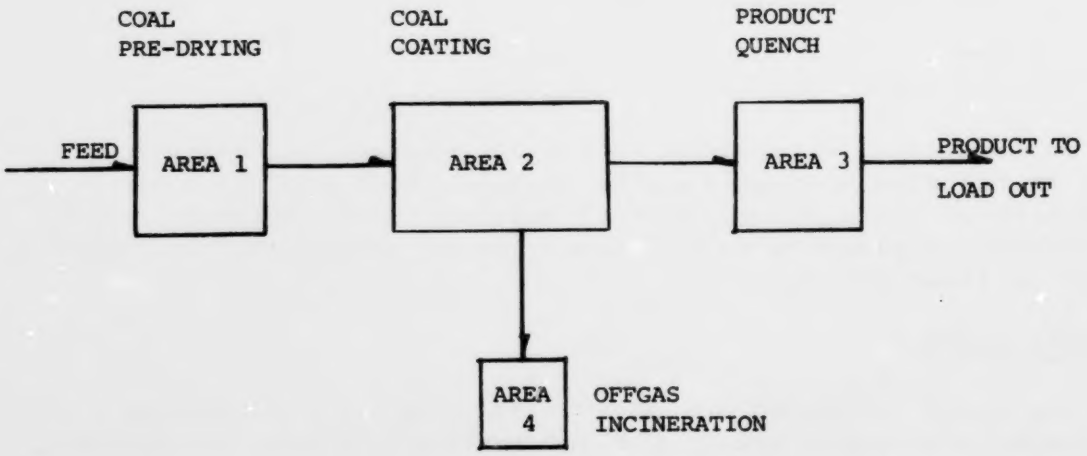

MINE
BENEFICIATION
PRODUCT STORAGE
PRODUCT LOAD OUT TERMINAL
PITCH COATING PROCESS

FIGURE 2 PITCH COATING PROCESS; PRINCIPAL AREAS


COAL PRE-DRYING
COAL COATING
PRODUCT QUENCH
FEED
AREA 1
AREA 2
AREA 3
PRODUCT TO LOAD OUT
AREA 4
OFFGAS INCINERATION

conveyor of the product coal at the output. This is to say that the design assumes location adjacent to a coal beneficiation plant as in Figure 1. The assumed provisions associated with the beneficiation plant are feed reclaim and product storage equipment that can be connected to the pitch coating plant conveyor for supplying the process with feed and for removing the product from the process for shipment.

With regard to the above considerations, the pitch coating process would consist of four basic areas:

1. Raw Coal Predrying

   Process: Fluidized bed dryer; 3 units
   Heat Source: Coal fines/natural gas for start-up

2. Coal Immersion/Coating with Pitch

   Process: Rotary tumbler/Kiln; 1 unit
   Heat Source: Natural gas/coal fines

3. Product Quenching

   Process: Rotary tumbler; 1 unit
   Heat Transfer Media: Cooling water/pond

4. Process Off-Gas Incineration

   Process: Furnace and Stack; 1 unit
   Heat Source: Coal fines

The process area is provided with pitch storage and heaters as well as transfer conveyors. The cooling water pond with the exception of circulation pumps is assumed to be included in the beneficiation plant battery limit. The schematic of the overall plant is shown in Figure 2.

CAPITAL COSTS

All the costs estimated are on an installed basis including concrete, structural steel, piping, instrumentation, electricals, field labour and indirect costs. As discussed in the conceptual design, the estimate excludes the cooling water, roads and buildings. These are assumed to be associated with beneficiation plant to which the process is attached.

Estimates were generated using the method of Guthrie (Guthrie, K.M., "Process Plant Estimating, Evaluation and Control", Solona Beach, California, Craftsman Publishing; 1974). Accordingly the capital costs were generated for the major equipment using a factored approach;

Capital Cost = FOB Equipment Cost x f_1 x f_2 x f_3 x f_4 etc.

f_1 = installation factor for the specific piece of equipment based on previous installation data for that equipment; reflecting the complexity

f_2 = currency and location factor to take US Gulf Coast cost data (base year 1968) to Edmonton, Alt. location in 1984 $Can.

e.g. = 2.96 $(\frac{1984}{1968})$ x 1.3 exchange x 1.3 location = 5

f_3 = metallurgy cost factor for materials of construction e.g. for corrosion resistance like CrMo steel = 1.45 typically

f_4 = pressure temperature factor for cost of special fabrication required in equipment used outside a normal pressure/temperature range

MAJOR EQUIPMENT DESIGN AND COST BY AREA

AREA 1 RAW COAL PREDRYING

Method: Fluidized bed (industry standard)
requires: 3500 to 4500 KJ/kg H_2O removed of process heat (i.e. coal fines)
: electrical demands 0.037 kWh/lb of H_2O

Design:

Theoretical heat requirement $= M_{coal} \times Cp \times T + M_{H_2O} \; H_{vap}$
$= 500\,000 \text{ kg} \times 0.3 \frac{\text{kcal}}{\text{kg °C}} \times 110\text{°C} + 50\,000 \times 636.09 \text{ kcal/kg}$
= 202.28 GJ/h assuming 60% efficiency implies that the energy input would be 337.13 GJ/h.

Typical design requires ≅ 4000 KJ/kg H_2O,unit requirement of about 200 GJ/h @ 60% efficiency = 333.3 GJ/h.

Capital Costs, Area 1

(a) Feed conveyors, 3 @ 50' length
FOB equipment $50^{0.65}$ = \$ 12.7M US
f_1 = 1.64
f_2 = 5.0
Total = \$104.1M Can.
x 3 = \$312.3M Can.

(b) Fluidized Bed Dryer, 3 @ 17' dia x 40' height
FOB equipment = \$ 40M US
f_1 = 2.0
f_2 = 5.0
f_3 = 4.0
Total = \$ 1.6MM
x 3 = \$ 4.8MM

Total Area Costs = \$ 5.11MM Can.

AREA 2 PITCH COATING

Method: Tumbler/Rotary Kiln
Constraints:
max 15% of tumbler volume occupied
min time for passage = 0.19 L/NDS
where L = length, feet
N = rpm rotation
D = diameter, feet
S = slope (0.25 - 0.75 in/ft)

- max. periphery speed 125 ft/min
- 15 min. retention time, 567.3 m^3/h throughput and 15% operating volume
- implies tumbler volume = 945 m^3 or 50.6 m length x 4.9 m Ø
- therefore a periphery speed = 110 ft/min would mean

$$\text{rpm} = \frac{\text{periphery speed}}{\pi D}$$

$$= 2.18 \text{ rpm}$$

for a 15 min retention time $\text{slope} = \dfrac{0.19 \times L}{15 \times N \times D}$

$= 0.060$ ft/ft or 0.72"/ft

- Heat Duty: Tumbler
  Predried coal input @ 120°C
  Treatment Temperature @ 280°C $\Delta T = 160°C$

$$Q = 460 \text{ tonnes coal} \times c_p @ \frac{1255 \text{ kJ}}{\text{tonne °C}} \times 160°C + 40 \text{ tonnes } H_2O$$

$$\times \frac{1144 \text{ MJ}}{\text{tonne}}$$

$$= 138.13 \text{ GJ/h}$$

- Heat Duty: Pitch Preheats to 320°C from 100°C (storage temperature)

$$Q = 40 \text{ tonnes} \times 2.092 \text{ MJ/T°C} \times 220°C$$
$$= 18.41 \text{ GJ/h}$$

AREA 2 **PITCH COATING** Continued

- Heat Duty: Pitch Storage average R-12 insulation for two 8500 bbl tanks

$$Q = 0.0833 \times 73{,}700\ \text{ft}^2 \times 200^\circ\text{F}$$
$$= 1{,}228{,}333\ \text{BTU/h}$$
$$= 1.3\ \text{GJ/h}$$

Total Heat Duty = 138.13 GJ/h
18.41 GJ/h (includes atmospheric losses)
1.30 GJ/h
156.84 GJ/h

Capital Costs, Area 2

(a) Pitch Heater (CrMo tubes, coal fines firing)
FOB equipment cost = $ 40M
f_1 = 2.25
f_2 = 5.0
f_3 = 1.45
Total = $652.5M

(b) Pitch Pump (1 + 1 spare @ 100 USGPM)
FOB equipment cost = $ 17.2M
f_1 = 3.5
f_2 = 5.0
f_3 = 1.93
Total x2 = $ 1.162MM

(c) Pitch Storage (2 tanks @ 85,000 bbl/heat traced)
FOB equipment cost = $ 70.0M
f_1 = 2.5
f_2 = 5.0
Total x 2 = $ 1.75MM

(d) Coating Tumbler (16' dia x 200' length - direct fired
FOB equipment cost = $700M
f_1 = 3.0
f_2 (base 1970) = 4.4
Total = $9.24 MM

Area Total $12.802 MM

AREA 3 PRODUCT COOLING

Method: Tumbler/quencher followed by screen 4.9 m dia x 25.3 m length

Cooling Duty

Q = 500 tonnes product/h x 1.32 MJ/T°C x (280 - 50)

= 152.03 GJ/h

$$m_{H_2O} = 152\ 030 \text{ MJ} \times \frac{1}{\text{eff.}=0.8} \times \frac{1}{\frac{4.184 \text{ MJ}}{\text{tonne °C}}} \times \frac{1}{(50-20°C)}$$

= 1515 tonnes H_2O/h

25.25 m^3/min (6700 USGPM)

AREA 3 **PRODUCT COOLING** Continued

Capital Cost, Area 3

(a) Product Cooler 16'Ø/100' L
FOB equipment cost = \$175M
f_1 = 3.0
f_2 (1970) = 4.4
Total = \$2.31MM

(b) Vibrating Screen @ 800 ft^2
FOB equipment cost = \$80M
f_1 = 1.32
f_2 = 5.0
Total = \$528.0M

(c) Water Circulation Pumps, 1 + 1 spare @ 6700 USGPM
FOB equipment cost = \$75.6M
f_1 = 3.4
f_2 = 5.0
Total x 2 = \$2.571MM

(d) Product conveyor, 1 @ 100 ft
FOB equipment cost $100^{0.65}$ = \$20M
f_1 = 1.64
f_2 = 5.0
Total = \$164M

Total Area 3 Costs = \$5.573MM

AREA 4 TUMBLER GAS INCINERATION

Method: Direct Fired Furnace and Stack

Volume of gas = 220M m^3/h @ 280°C
Incineration Temp. = 540°C

Heat Duty

Q = 40 tonnes H_2O vap x 511.7 MJ/tonne + 220 tonnes
= 55.36 GJ/h @ 70% eff. input = 79.1 GJ/h of coal fines

Capital Cost, Area 4

Incinerator, stacks, furnace and blower
FOB equipment cost = $61.7M
f_1 = 1.62
f_2 = 5.0
Total = $500M

Total Area Cost = $500M

The capital cost of the plant, therefore, exclusive of contingency would be about $18 million if the predrying and gas incineration could be eliminated. Gas incineration could add about $0.5 million and predrying about $5 million. The accuracy of these estimates is ±50%.

OPERATING COSTS

(a)	1)	Operating labour 8/shift including shift supervisor		
		24-hour operation factor = 4.2 x 8 = 34 people @ $40M/a		
	2)	Operating Supervisor		1 @ $70M/a
	3)	General Supplies @ 15% of above		= $0.210MM/a
		Total Direct Labour		$1.640MM/a
(b)	1)	Maintenance Labour	3/shift	
		Shift Supervisor	1/shift	
		24 h operation factor	4.2	
		=	17 @ $40M	
	2)	Maintenance Supplies		
		@ 2.8% of capital		= $890M
		Total Direct Maintenance		= $1.57MM
(c)		Power - 40 000 MWh/a @ $30/MWh		= $1.20MM
		Coal Fines 274 340 tonnes/a @ $0		= $0.00MM

OPERATING COST SUMMARY

		$/Tonne	M$/a
1.	LABOUR		
	• Operating Labour 34 @ $40M + Plant Supervisor 1 @ 70M	0.40	4,430
	• General Supplies @ 15%	0.06	210
	TOTAL LABOUR	0.46	1,640
2.	MAINTENANCE		
	• Combined Labour & Maintenance Costs @ 5% of Capital	0.44	1,570
	SUBTOTAL 1 + 2	0.90	3,210
3.	OPERATING EXPENSES		
	• Fuel (burn coal fines @ $0 cost)	0.00	0,000
	• Power @ 3¢/Kwh	0.33	1,200
	TOTAL OPERATING EXPENSES	0.33	1,200
	SUBTOTAL OPERATING COST	1.23	4,410
4.	OVERHEADS @ 30%	0.37	1,320
	SUBTOTAL	1.60	5,730
5.	CONTINGENCY @ 20%	0.32	1,150
	TOTAL OPERATING COST	$1.92	$6,880

TASK REPORT #7 - DESIGN OF COAL BENEFICIATION PILOT PLANT

1. SUMMARY

Various options to operate this coal beneficiation process in a continuous mode on a pilot plant scale were examined. Two options were selected for more detailed design and estimates of the basic construction cost of the main units were made. No consideration in this report was given to ancillary equipment or facilities which might be needed to install and operate these units at an operating mine.

2. DESIGN BASIS

2.1 Coal

Particle Size	8 mesh x 1"
Bulk Density	50 lb/ft^3
Flow rate, normal	41.7 lb/h, 0.83 ft^3/h (range 16-53 lb/h)
Specific Heat	0.35 BTU/lb, °F
Bound Water Content	10%

2.2 Residuum

Consumption	9% of coal mass flow
Specific gravity	0.9
Specific heat	0.4 BTU/lb, °F
Viscosity	100 cSt @ 300°C 990 cSt @ 150°C

2.3 Residence Time in Reactor

Time	15 minutes

3. PILOT PLANT DESCRIPTION

3.1 Alternative 1

The flow sheet for this option is shown in Figure 1.

3.1.1 Predried coal is loaded into hopper B-1 which supplies a variable rate vibratory feeder, FDR-1. Coal is fed (approximately 1 ft^3/h) into a "reactor" comprising an inclined variable speed drag conveyor (C-1), the lower half of which is submerged in a residuum bath (TK-3) kept at 600°F. Coal is dragged through the hot liquid residuum (residence time approximately 15 minutes); the residuum bath coats the coal particles and penetrates their pores. The upper half of the conveyor drag plate is a bar screen which allows excess residuum to drain off and return to the bath. Drained coal is dumped onto a vibrating screen (VS-1) through which air is blown to cool the coal to at least 250°F. The cooled coal leaving VS-1 is collected as product.

3.1.2 A residuum make-up system compensates for residuum consumption by maintaining a constant liquid level in the bath. Make up tanks TK-1 and TK-2 are each sized to allow twice normal consumption for the duration of one shift (8 hours). Thus, a make-up tank can be loaded with residuum at the start of a shift and slowly brought up to temperature during the shift while the alternate tank supplies the unit.

3.1.3 The concentration of sub 8 mesh coal fines in the residuum bath is minimized by filtration. A closed circulation loop (5 USGPM) constantly pumps residuum through a duplex strainer and returns it to the bath. Pressure drop across the strainer and pump discharge pressure indicate when a strainer needs to come off stream for cleaning.

The estimated cost for this basic equipment is $50,000. The details are given in the Appendix.

3.2 Alternative 2

The drag conveyor and vibrating screen components could be replaced by rotary dryer type units. The "reactor" unit could be slightly inclined with the lower end partially submerged in hot residuum. Helical flights would tumble the coal in and lift it out of residuum as it flowed upward and through the rotating cylinder. The hot, coated coal would then be fed into another rotating inclined cylinder through which counter current cooling air is blown. Flights in the cylinder would assist in tumbling the coated particles, increasing exposure to the cooling air stream and minimizing agglomeration. The estimated installed cost of these units is about $3,000 each. This represents a saving of $6,000 compared to using the drag conveyor and vibrating screen.

The flowsheet for this option is shown in Figure 2 and the cost details are given in the Appendix.

APPENDIX

TASK #7

E-194-BL (8-79)

PROJECT NO. / PROJET Nº + 98417
BY / PRÉSENTÉ PAR
LOCATION / ENDROIT

COST ESTIMATE
ESTIMATION DU PRIX DE REVIENT

FOR / DESTINÉ À 1/2 TPD COAL BENEFICIATION PLANT

PAGE 1 OF / DE 5
DATE Sept. 17, 1984
EST. NO. / EST. Nº

SECTION NO. / SECTION Nº		QUANTITY / QUANTITÉ	UNIT / UNITÉ	UNIT COST / COÛT UNITAIRE		COST / COÛT		
				MATERIAL / OUTILLAGE	LABOUR / MAIN-D'OEUVRE	MATERIAL / OUTILLAGE	LABOUR / MAIN-D'OEUVRE	TOTAL
	SUMMARY							
	ALTERNATIVE 1							
	Total from Page 2							23,076
	Total from Page 3							15,852
	Total from Page 4							3,600
	Sub-Total							42,528
	Add Contingency							7,472
	GRAND TOTAL (Base Case)							50,000
	ALTERNATIVE 2							
	Total from Page 5							44,000

[illegible]-194-BL ([illegible])

PROJECT NO. / ***PROJET Nº*** + 98417
BY / ***PRÉSENTÉ PAR***
LOCATION / ***ENDROIT***

COST ESTIMATE
ESTIMATION DU PRIX DE REVIENT

FOR / ***DESTINÉ À*** 1/2 TPD COAL BENEFICIATION PLANT

PAGE 2 **OF** / ***DE*** 5
DATE Sept. 17, 1984
EST. NO. / ***EST. Nº***

SECTION NO. / *SECTION Nº*		QUANTITY / *QUANTITÉ*	UNIT / *UNITÉ*	UNIT COST / *COÛT UNITAIRE*		COST / *COÛT*		
				MATERIAL / OUTILLAGE	LABOUR / MAIN-D'OEUVRE	MATERIAL / OUTILLAGE	LABOUR / MAIN-D'OEUVRE	TOTAL
	FEEDER HOPPER ≅ 15 ft³	1	Each	$2,000		$2,000		$ 2,000
	(Installation - see Feeder)							
	FEEDER - AEG 1 ft³/h	1	Each	4,500		4,500		4,500
	Installation	16	Hours		32		$ 512	512
	DRAG CONVEYOR	1	Each			3,000		3,000
	Installation	32	Hours		32		1,024	1,024
	RESIDUUM TANK - 25 USG c/w Insul.	1	Each			3,000		3,000
	Installation (see Reactor)							
	HEATERS ≅2.5 kW ea (for residuum tank)	6	Each	400		2,400		2,400
	VIBRATING SCREEN	1	Each	6,000		6,000		6,000
	Installation	20	Hours		32		640	640
	TOTAL PAGE 2							$23,076

B-104-BL (8-79)

COST ESTIMATE
ESTIMATION DU PRIX DE REVIENT

PROJECT NO. / *PROJET Nº* + 98417
BY / *PRÉSENTÉ PAR*
LOCATION / *ENDROIT*
FOR / *DESTINÉ À* 1/2 TPD COAL BENEFICIATION PLANT

PAGE 3 **OF** / *DE* 5
DATE Sept. 17, 1984
EST. NO. / *EST. Nº*

SECTION NO. / *SECTION Nº*		QUANTITY / *QUANTITÉ*	UNIT / *UNITÉ*	UNIT COST / *COÛT UNITAIRE* MATERIAL / *OUTILLAGE*	UNIT COST / *COÛT UNITAIRE* LABOUR / *MAIN-D'OEUVRE*	COST / *COÛT* MATERIAL / *OUTILLAGE*	COST / *COÛT* LABOUR / *MAIN-D'OEUVRE*	TOTAL
	VENT SYSTEMS							
	HOOD	2	Each	$2,000		$4,000		$ 4,000
	FAN	2	Each	750		1,500		1,400
	Installation	40	Hours		32		$1,280	1,280
	RESIDUUM MAKE-UP SYSTEM							
	TANK 915 USG) c/w Insulation	2	Each	1,500		3,000		3,000
	HEATER 2 kW	2	Each	500		1,000		1,000
	PUMP 1 USGPM	1	Each	1,000		1,000		1,000
	Installation	30	Hours		32		960	960
	RESIDUUM FILTER SYSTEM							
	FILTER (Single Basket)	2	Each	300		600		600
	PUMP (5 USGPM)	1	Each	2,000		2,000		2,000
	Installation	16	Hours		32		512	512
	TOTAL PAGE 3							$15,852

E-194-BL (8-79)

PROJECT NO. / *PROJET Nº* + 98417

BY / *PRÉSENTÉ PAR*

LOCATION / *ENDROIT*

COST ESTIMATE

ESTIMATION DU PRIX DE REVIENT

FOR / *DESTINÉ À* 1/2 TPD COAL BENEFICIATION PLANT

PAGE 4 OF / *DE* 5

DATE Sept. 17, 1984

EST. NO. / *EST. Nº*

SECTION NO. / *SECTION Nº*		QUANTITY / *QUANTITÉ*	UNIT / *UNITÉ*	UNIT COST / *COÛT UNITAIRE*		COST / *COÛT*		
				MATERIAL / OUTILLAGE	LABOUR / MAIN-D'OEUVRE	MATERIAL / OUTILLAGE	LABOUR / MAIN-D'OEUVRE	TOTAL
	TIC's							
	RESID M/U TANKS	2	Each	$ 300		$ 600		$ 600
	RESID TANK	1	Each	300		300		300
	LC's							
	RESID TANK	1	Each	500		500		500
	PI's							
	FILTER	2	Each	50		100		100
	PUMPS (1 ea.)	2	Each	50		100		100
	MISC PIPING, FLEX SLEEVES etc.					500		500
	MISC STEEL PLATE, ANGLE etc.					500		500
	CONCRETE BASES etc.					1,000		1,000
	TOTAL PAGE 4							$3,600

R-194-BL (8-79)

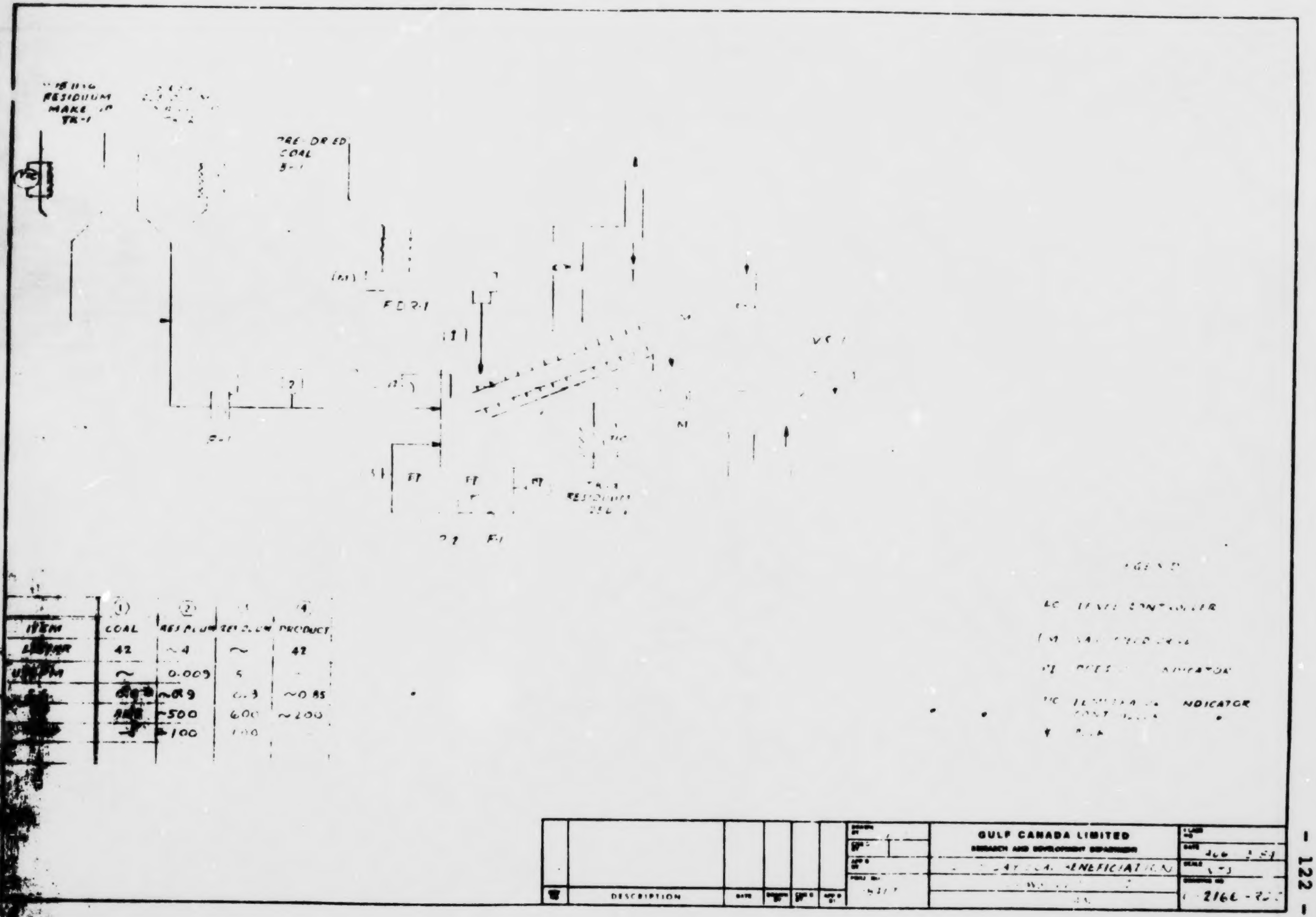
PROJECT NO. *PROJET N°* + 98417
BY *PRÉSENTÉ PAR*
LOCATION *ENDROIT*

COST ESTIMATE
ESTIMATION DU PRIX DE REVIENT

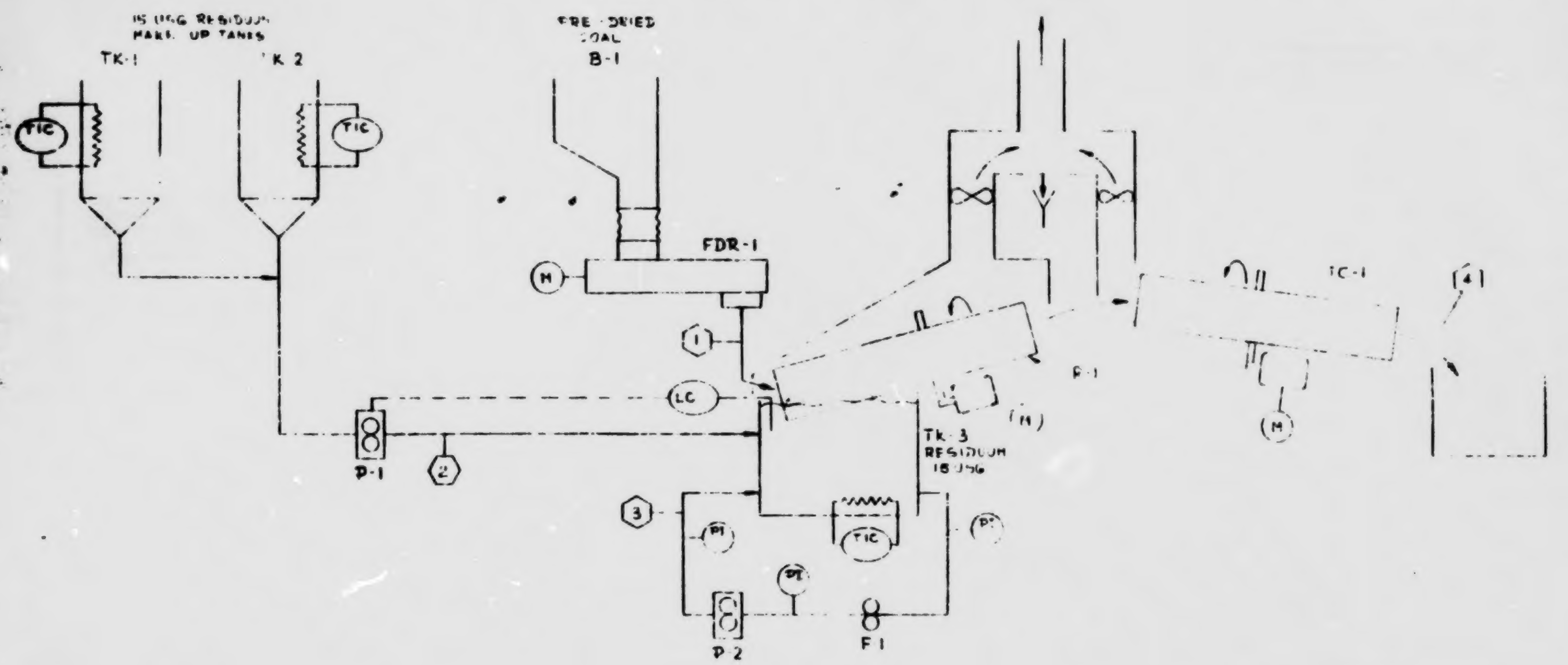
FOR *DESTINÉ À* 1/2 TPD COAL BENEFICIATION PLANT

PAGE 5 **OF** *DE* 5
DATE Sept. 17, 1984
EST. NO. *EST. N°*

SECTION NO. *SECTION N°*		QUANTITY *QUANTITÉ*	UNIT *UNITÉ*	UNIT COST *COÛT UNITAIRE*		COST / *COÛT*		
				MATERIAL OUTILLAGE	LABOUR MAIN-D'OEUVRE	MATERIAL OUTILLAGE	LABOUR MAIN-D'OEUVRE	TOTAL
	ALTERNATIVE 2							
	ALTERNATIVE 1 COST							$50,000
	ADJUSTMENTS							
	DELETE DRAG CONVEYOR - PAGE 1	1						(3,000)
	DELETE VIBRATING SCREEN - Page 1	1						(6,000)
	DELETE RESIDUUM TANK - Page 1	1						(3,000)
	ADD:							
	ROTARY "REACTOR" c/w TANK	1	Each			$ 3,000		3,000
	ROTARY COOLER	1	Each			3,000		3,000
	GRAND TOTAL (ALT. CASE)							$44,000


RESIDUUM
MAKE UP
TK-1
TIC
PRE DRIED
COAL
B-1
FDR-1
P-1
2
VS-1
TK-3
RESIDUUM
FT
FT
PT
P1
LEGEND
LC LEVEL CONTROLLER
PI PRESSURE INDICATOR
TIC TEMPERATURE INDICATOR CONTROLLER
DESCRIPTION
DATE
GULF CANADA LIMITED
RESEARCH AND DEVELOPMENT DEPARTMENT
BENEFICIATION
2166 -

	①	②	3	④
ITEM	COAL	RESIDUUM	RESIDUUM	PRODUCT
[illegible]	42	~4	~	42
[illegible]	~	0.009	5	-
[illegible]	[illegible]	~0.9	0.9	~0.85
[illegible]	[illegible]	~500	600	~200
[illegible]	[illegible]	~100	100	


15 USG RESIDUUM MAKE UP TANKS
TK-1
TK-2
TIC
TIC
PRE-DRIED COAL
B-1
FDR-1
M
1
LC
P-1
2
TK-3
RESIDUUM
15 USG
3
PI
TIC
PI
P-2
F-1
PI
M
P-1
TC-1
M
4

	⬡1	⬡2	⬡3	⬡4	
	COAL	RESIDUUM	RESIDUUM	PRODUCT	
[illegible]	42	~4	~	42	
[illegible]	~	0.009	5	-	
[illegible]	[illegible]	~0.9	0.9	~0.86	
[illegible]	[illegible]	~500	600	~200	
[illegible]	-	~160	100	-	

LEGEND

(LC) LEVEL CONTROLLER
(M) VARI SPEED DRIVE
(PI) PRESSURE INDICATOR
(TIC) TEMPERATURE INDICATOR CONTROLLER
✱ BULK

	DESCRIPTION				

DRAWN BY B.P.
JOB NO. 98417

GULF CANADA LIMITED
RESEARCH AND DEVELOPMENT DEPARTMENT
1/2 TON/DAY COAL BENEFICIATION
FLOWSHEET (ALT.)
PILOT PLANT

DATE 7 AUG 84
SCALE NONE
DRAWING NO. 2174-RD 0

CONVERSION CHART

Units of coal particle size in this report are those commonly used in the coal industry. Their corresponding values in metric units are summarized below for easy reference.

1 1/2"	38.1 mm
1"	25.4 mm
1/2"	12.7 mm
3/8"	9.5 mm
1/4"	6.3 mm
16 mesh	1.0 mm

TABLE WD-1
SUMMARY OF EXPERIMENTAL RESULTS (WD SERIES)

	1/2" x 3/8" (S_1)			3/8" x 1/4" (S_2)			1/4" x 16 m (S_3)			
	L_1 (10 min)	L_2 (20 min)	L_3 (30 Min)	L_1	L_2	L_3	L_1	L_2	L_3	
	5	4	7	6	1	3	2	9	8	Run #
T_1 (280°C)	282	282	282	281	269	278	278	283	279	Aver. Tempt., °C
	90.4	90.0	87.8	87.1	90.9	91.7	98.8	96.0	95.2	Product Yield, %
	12.3	12.0	11.4	11.5	11.8	-	12.7	11.9	11.6	H_2O Recovered, %
	1.6	1.6	1.7	1.7	1.8	2.1	1.7	-	1.0	Gas Vol. (Litre)
	5.02	6.53	4.33	4.97	6.61	7.64	14.16	11.52	10.25	Residuum Content, %
	13	18	16	17	10	14	11	15	12	
T_2 (300°C)	305	303	302	307	303	301	307	300	306	
	92.5	91.1	91.6	92.5	90.8	91.4	95.7	95.7	95.6	
	11.8	12.3	12.5	12.7	11.6	11.0	10.9	11.7	11.3	
	0.6	0.6	2.0	1.5	2.0	2.0	1.5	-	1.8	
	6.86	6.18	5.79	5.95	5.14	8.04	10.12	13.60	16.52	
	22	26	25	27	21	19	23	20	24	
T_3 (320°C)	320	319	319	326	308	320	318	315	321	
	91.2	91.9	89.4	91.7	93.1	92.7	96.2	94.6	95.1	
	12.9	12.1	12.5	11.8	11.8	11.8	11.9	10.8	11.5	
	-	1.4	1.8	1.2	-	1.6	-	-	-	
	8.53	7.49	6.55	5.57	9.46	8.84	18.23	10.63	16.50	

TABLE WD-2
PROXIMATE ANALYSIS, SULFUR, HEATING VALUE, AND RESIDUAL MOISTURE DETERMINATIONS ON UPGRADED PRODUCTS

Sample No.		%* H_2O	% H_2O	% Volatile Matter	% Ash	% Fixed Carbon	S%*	BTU/lb*
WD-1	As Received	0.13	2.45	32.73 (33.28)	22.47 (21.34)	42.35	-	9,780 9,674+
WD-2	As Received	<0.1	2.48	33.04 (33.79)	23.99 (22.27)	40.49	-	9,928
WD-3	As Received	<0.1	1.56	34.45 (32.32)	15.97 (21.16)	48.02	0.82	10,535
WD-4	As Received	<0.1	1.23	32.82 (33.75)	22.75 (20.56)	43.20		9,867
WD-5	As Received	<0.1	1.40	34.41 (32.73)	16.38 (20.46)	47.81		10,546 10,599+
WD-6	As Received	<0.1	1.17	32.01 (32.83)	24.20 (22.27)	42.62		9,629
WD-7	As Received	<0.1	2.28	31.23 (31.89)	22.70 (21.07)	43.79	0.68	9,887
WD-8	As Received	<0.1	1.14	33.22 (33.92)	24.71 (23.11)	40.93	0.98	9,768
WD-9	As Received	0.26	1.58	32.87 (34.09)	25.68 (22.92)	39.87		9,481
WD-10	As Received	<0.1	1.19	33.31 (32.88)	20.35 (21.37)	45.15		10,379
WD-11	As Received	<0.1	1.17	32.92 (33.75)	24.88 (22.99)	41.03	0.97	10,036
WD-12	As Received	<0.1	1.36	33.68 (34.88)	25.66 (23.01)	39.30		9,913
WD-13	As Received	<0.1	1.20	32.74 (33.02)	20.68 (20.00)	45.38	0.65	9,847
WD-14	As Received	<0.1	1.98	31.26 (32.04)	23.15 (21.23)	43.61		9,398
WD-15	As Received	<0.1	1.48	40.73 (43.12)	27.25 (22.99)	30.54		8,976 9,245+
WD-16	As Received	<0.1	1.30	39.92 (42.37)	24.82 (20.20)	33.96		9,131
WD-17	As Received	<0.1	.70	32.95 (33.00)	21.10 (20.97)	45.25	0.72	10,004
WD-18	As Received	<0.1	.72	32.33 (32.19)	19.96 (20.31)	46.99		10,229
WD-19	As Received	<0.1	.96	32.74 (32.94)	21.40 (20.93)	44.90		10,095
WD-20	As Received	<0.1	.91	33.02 (33.66)	24.73 (23.26)	41.34		9,860
WD-21	As Received	<0.1	1.10	33.60 (33.04)	19.49 (20.84)	45.81		10,529
WD-22	As Received	<0.1	0.66	33.11 (32.47)	18.73 (20.29)	47.50		10,526
WD-23	As Received	<0.1	0.77	34.47 (35.54)	25.20 (22.87)	39.56		9,885 9,925+
WD-24	As Received	0.81	1.02	33.54 (33.75)	23.60 (23.13)	41.84		10,128
WD-25	As Received	<0.1	0.80	33.34 (32.37)	18.31 (20.69)	47.55		10,635
WD-26	As Received	0.14	0.75	30.71 (34.23)	28.49 (20.13)	40.05	0.77	8,898 8,775+
WD-27	As Received	<0.1	1.24	32.25 (32.91)	22.74 (21.16)	43.77	0.76	9,955 9,846+

(Ash) - Theoretical Ash of product
(VM) - Adjusted value for volatile matters based on theoretical ash

*Gulf R&D Department
+BTU/lb Checks from subcontract laboratory

TABLE WD-3

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS

Sample No.	% H_2O	% C	%* H	% N	% Ash	% S	%* O(diff)
WD-3	1.09	63.11	4.38	0.52	17.44	0.82	12.64
WD-7	1.25	54.99	3.53	0.61	23.03	0.68	15.91
WD-8	0.97	55.14	3.77	0.57	24.53	0.98	14.04
WD-11	0.71	56.86	3.77	0.59	25.58	0.97	11.52
WD-13	1.06	61.04	3.81	0.63	21.22	0.65	1.59
WD-17	1.30	59.96	3.13	0.61	21.43	0.72	12.85
WD-26	0.86	52.94	3.59	0.58	30.34	0.77	10.92
WD-27	0.84	56.25	3.47	0.65	24.74	0.76	13.29

*Hydrogen and Oxygen do not include H and O in sample moisture.

TABLE WD-4

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS

(After Ash is Adjusted to Theoretical Value)

Sample No.	% H_2O	% C	%* H	% N	% Ash	% S	%* O(diff)
WD-3	1.03	59.21	4.11	0.49	21.16	0.77	13.23
WD-7	1.27	56.15	3.60	0.62	21.07	0.69	16.60
WD-8	0.99	56.31	3.85	0.58	23.11	1.00	14.16
WD-11	0.73	58.29	3.86	0.60	22.99	0.99	12.54
WD-13	1.07	61.56	3.84	0.64	20.00	0.66	12.23
WD-17	1.30	60.06	3.13	0.61	20.97	0.63	13.30
WD-26	0.96	59.00	4.00	0.65	20.13	0.86	14.40
WD-27	0.86	57.40	3.54	0.66	21.26	0.78	15.60
Raw Coal (#3,17,27)	12.14	49.36	2.93	0.58	19.37	0.30	15.07
Raw Coal (#7,13,26)	12.23	51.51	2.89	0.66	18.81	0.30	13.69
Raw Coal (#8,11)	11.67	46.30	2.29	0.50	21.99	0.32	16.66

*Hydrogen and Oxygen do not include H and O in sample moisture.

TABLE WM-1

SUMMARY OF EXPERIMENTAL RESULTS (WM SERIES)

	1/2" x 3/8"			3/8" x 1/4"			1/4" x 16 m			
	L_1 (10 min)	L_2 (20 min)	L_3 (30 Min)	L_1	L_2	L_3	L_1	L_2	L_3	
	6	4	5	1	2	3	9	7	8	Run #
T_1 (280°C)	270	275	278	285	282	283	278	274	276	Aver. Tempt., °C
	89.3	89.4	90.0	90.6	91.7	89.6	93.2	90.2	97.1	Product Yield, %
	11.6	11.4	11.9	11.8	11.5	—	11.0	11.9	11.2	Water Recovered, %
	—	—	—	—	—	—	—	—	—	Gas Volume, (L)
	4.33	2.89	3.82	4.92	6.38	8.09	9.91	10.6	11.2	Residuum Content, %
	16	15	12	11	10	13	18	14	17	
T_2 (240°C)	249	253	252	243	247	243	249	243	246	
	91.6	90.5	93.3	95.9	89.0	94.3	105.6	97.9	102.8	
	12.3	12.0	11.7	11.1	11.2	11.5	11.1	11.6	11.4	
	—	—	—	—	—	—	—	—	—	
	5.0	5.49	5.0	6.8	3.94	4.22	15.6	10.4	15.0	
	19	26	20	23	25	21	24	22	27	
T_3 (320°C)	312	324	317	325	322	321	317	314	320	
	89.7	90.8	89.0	91.5	89.3	90.0	89.0	92.0	94.3	
	11.4	12.0	11.8	—	12.1	—	12.0	11.0	12.3	
	—	—	—	—	—	—	—	—	—	
	4.73	6.27	5.40	11.4	8.15	8.48	10.4	13.4	13.5	

TABLE WM-2
PROXIMATE ANALYSIS, SULFUR, HEATING VALUE, AND RESIDUAL MOISTURE DETERMINATIONS ON UPGRADED PRODUCTS

Sample No.		%* H_2O	% H_2O	% Volatile Matter	% Ash	% Fixed Carbon	S%*	BTU/lb*
WM-1	As Received	0.88	1.26	32.38 (33.33)	23.65 (21.41)	42.71	0.64	9,459
WM-2	As Received	0.55	1.05	32.60 (33.67)	23.66 (21.16)	42.69	0.59 0.59+	9,674 9,641+
WM-3	As Received	0.57	1.21	33.24 (32.62)	20.15 (21.65)	45.40	0.68·	10,021
WM-4	As Received	0.29	1.05	32.42 (33.04)	22.18 (20.69)	44.35	0.63 0.55+	9,862 9,634+
WM-5	As Received	0.58	1.20	32.98 (32.50)	19.39 (20.56)	46.43	0.62	10,253
WM-6	As Received	0.40	1.13	33.41 (32.78)	19.19 (20.72)	46.27	0.63	10,148
WM-7	As Received	0.54	1.15	34.58 (34.22)	23.59 (24.39)	40.68	1.05 0.97+	9,915 9,820+
WM-8	As Received	0.79	1.22	34.96 (35.38)	23.58 (22.60)	40.24	1.04	9,971
WM-9	As Received	0.69	0.83	34,71 (34.14)	22.34 (23.61)	42.12	0.96	10,021
WM-10	As Received	0.71	1.03	30.81 (34.00)	29.13 (21.80)	39.03	0.62 0.57+	8,702 8,794+
WM-11	As Received	0.28	1.04	33.32 (33.34)	20.29 (20.23)	45.35	0.76	10,051
WM-12	As Received	1.17	1.46	32.17 (33.58)	23.19 (19.83)	43.18	0.67	9,445
WM-13	As Received	1.48	1.30	31.89 (33.97)	25.43 (20.57)	41.38	0.66	9,300
WM-14	As Received	1.17	1.23	34.70 (35.84)	24.95 (22.49)	39.12	1.14 1.04+	9,683 9,558+
WM-15	As Received	0.53	0.93	32.56 (32.99)	21.47 (20.44)	45.04	0.63 0.55+	9,889 9,740+
WM-16	As Received	0.69	0.97	33.31 (33.69)	21.09 (20.20)	44.63	0.65	9,997
WM-17	As Received	0.70	2.20	34.28 (35.93)	25.00 (21.40)	38.52	1.11	9,799
WM-18	As Received	0.69	1.96	35.01 (35.96)	22.93 (20.83)	40.10	1.15	9,942
WM-19	As Received	0.19	1.18	31.89 (34.64)	26.91 (20.62)	40.02	0.67	9,055
WM-20	As Received	0.33	1.21	33.02 (32.14)	18.61 (20.79)	47.16	0.72	10,359
WM-21	As Received	0.58	1.24	34.05 (32.62)	18.11 (21.56)	46.60	0.81	10,538
WM-22	As Received	0.20	1.08	34.30 (34.70)	24.78 (23.91)	39.84	1.03 0.99+	9,859 9,920+
WM-23	As Received	0.57	1.50	34.98 (32.79)	15.94 (21.20)	47.58	0.86	10,933
WM-24	As Received	0.31	1.04	32.69 (32.73)	24.80 (24.72)	41.47	0.90	9,789
WM-25	As Received	0.90	1.26	33.16 (33.11)	21.60 (21.72)	43.98	0.70 0.71+	9,984 10,042+
WM-26	As Received	0.81	0.98	31.85 (32.85)	22.80 (20.37)	44.37	0.63 0.63+	9,775 9,826+
WM-27	As Received	1.17	0.95	33.18 (33.59)	24.26 (23.33)	41.61	0.97	9,771

*Gulf R/D Department

(Ash) - Theoretical Ash of product

(VM) - Adjusted value for volatile matters based on theoretical ash

+BTU/lb Checks from subcontract laboratory

NOTE: All samples as received

TABLE WM-3

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS

Sample No.	% H_2O	% C	% H*	% N	% Ash	% S	% O(diff)*
WM-2	1.55	55.04	3.76	0.73	23.99	0.59	14.34
WM-4	1.69	57.37	3.73	0.74	22.47	0.55	13.45
WM-7	1.58	56.85	3.97	0.68	22.97	0.97	12.98
WM-10	1.07	51.70	3.57	0.60	29.25	0.57	13.24
WM-14	1.54	54.90	3.98	0.68	24.17	1.04	13.69
WM-15	0.93	58.09	3.72	0.73	21.57	0.55	14.41
WM-22	1.10	56.82	4.11	0.68	25.01	0.99	11.29
WM-25	1.39	58.72	3.63	0.70	21.51	0.71	13.34
WM-26	1.31	57.42	3.79	0.67	22.96	0.63	13.22

* H and O do not include H and O in Sample Moisture.

TABLE WM-4

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS
(After Ash is adjusted to theoretical value)

Sample No.	% H_2O	% C	%* H	% N	% Ash	% S	%* O(diff)
WM-2	1.60	56.84	3.88	0.75	21.16	0.61	15.16
WM-4	1.72	58.47	3.80	0.75	20.69	0.56	14.01
WM-7	1.56	56.25	3.93	0.67	24.39	0.96	12.24
WM-10	1.18	57.05	3.94	0.66	21.80	0.63	14.74
WM-14	1.59	56.70	4.11	0.70	22.49	1.07	13.34
WM-15	0.94	58.85	3.77	0.74	20.44	0.56	14.70
WM-22	1.11	57.48	4.16	0.69	23.91	1.00	12.65
WM-25	1.39	58.63	3.62	0.70	21.72	0.71	13.23
WM-26	1.35	59.23	3.91	0.69	20.37	0.65	13.80

*H and O do not include H and O in Sample Moisture.

TABLE WE-1
SUMMARY OF EXPERIMENTAL RESULTS (WE SERIES)

	1/2" x 3/8" (S_1)			3/8" x 1/4" (S_2)			1/4" x 16 m. (S_3)			
	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3	
T_1 (240°C)	6	1	4	7	2	5	9	3	8	Run #
	245	238.5	239.9	240	237.5	236.3	242.9	237.9	244.1	Average Temp. (°C)
	94.1	91.9	92.3	94.3	93.2	91.6	97.9	100.2	99.7	Product Yield, %
	11.9	11.7	12.2	11.6	11.6	11.6	11.7	11.1	11.1	H_2O Recovered, %
	9.66	6.80	7.09	10.39	7.60	8.70	16.19	15.32	15.62	Residuum Content, %
T_2 (200°C)	13	10	15	14	11	16		12		
	201.7	204.8	201.6	202.7	200.5	202.6		210.0		
	93.2	94.2	93.6	94.7	95.5	95.3		106.2		
	11.9	11.7	11.8	-	11.1	11.3		11.0		
	10.05	8.47	12.2	11.59	12.30	11.71		18.0		
T_3 (380°C)	19	17	21	20	18	22				
	279.9	277.2	282.9	278.8	279.0	277.9				
	91.1	91.6	91.8	92.1	94.0	92.3				
	11.4	11.7	12.1	11.5	11.9	11.5				
	7.93	8.29	9.72	9.91	11.20	11.02				

TABLE WE-1A
SUMMARY OF EXPERIMENTAL RESULTS (WE SERIES)

	1/2" x 3/8" (S_1)	3/8" x 1/4" (S_2)	
	L_2	L_2	
T_1 (240°C)	1A	2A	Run #
	238	238	Average Temp. (°C)
	90.9	92.6	Product Yield, %
	11.7	11.6	H_2O Recovered, %
	9.74	13.92	Residuum Content, %
T_2 (200°C)	10A	11A	
	202	201	
	95.02	98.7	
	10.5	10.90	
	10.20	14.97	
T_3 (380°C)	17A	18A	
	279	277	
	92.3	92.50	
	11.2	11.5	
	6.58	7.50	

All runs 30 mins. draining time

TABLE WE-2
PROXIMATE, SULFUR AND HEATING VALUES OF UPGRADED PRODUCTS

Sample No.	% H_2O	% Volatile Matter	% Ash	% Fixed Carbon	S%	BTU/lb
WE-1	3.07	33.96 (35.87)	21.35 (20.13)	41.62	0.48	9,702
WE-2	2.46	32.78 (36.29)	26.01 (20.82)	38.75	0.48	8,965
WE-3	2.80	35.45 (37.66)	23.74 (21.96)	38.01	0.62	9,784
WE-4	2.61	34.49 (34.25)	16.88 (20.04)	46.02	0.52	10,393
WE-5	3.21	33.88 (36.36)	23.35 (21.18)	39.56	0.45	9,348
WE-6	2.60	35.28 (35.73)	18.08 (19.66)	44.04	0.45	10,231
WE-7	1.96	35.92 (34.72)	15.87 (20.57)	46.25	0.41	10,520
WE-8	1.97	34.77 (38.72)	28.06 (22.07)	35.20	0.60	9,085
WE-9	2.26	36.27 (37.70)	23.17 (22.47)	38.30	0.60	9,817
WE-10	3.53	34.33 (35.96)	19.77 (19.64)	42.37	0.45	9,905
WE-11	3.19	35.45 (36.22)	18.83 (20.31)	42.53	0.46	10,098
WE-12	2.88	38.51 (42.41)	25.13 (20.72)	33.48	0.66	9,857
WE-13	2.83	31.16 (38.38)	32.09 (19.85)	33.92	0.45	8,044
WE-14	3.73	33.76 (36.19)	22.11 (20.49)	40.40	0.45	9,423
WE-15	3.18	35.88 (35.92(	16.67 (19.76)	44.27	0.47	10,411
WE-16	2.74	35.83 (35.76)	17.46 (20.38)	43.97	0.45	10,168
WE-17	1.54	32.04 (36.14)	27.72 (20.20)	38.70	0.40	8,918
WE-18	1.65	35.07 (35.05)	18.94 (20.64)	44.24	0.50	10,163
WE-A1	2.63	32.14 (33.57)	23.15 (20.35)	42.08	0.44	9,368
WE-A2	4.48	33.42 (34.15)	18.62 (20.95)	43.48	0.56	9,903
WE-A10	3.10	33.51 (36.28)	21.63 (19.47)	41.76	0.50	9,525
WE-A11	2.96	34.12 (37.67)	23.46 (19.66)	39.46	0.54	9,589
WE-A17	2.27	32.60 (34.66)	21.98 (20.04)	43.15	0.45	9,844
WE-A18	2.31	34.08 (34.89)	19.33 (20.97)	44.28	0.45	10,084
WE-19	2.01	34.17 (34.79)	19.08 (20.31)	44.74	0.45	10,154
WE-20	2.36	33.40 (33.78)	19.62 (21.06)	44.62	0.51	9,813
WE-21	2.30	32.11 (34.99)	24.45 (20.15)	41.14	0.48	9,429
WE-22	2.33	32.22 (34.61)	24.15 (21.02)	41.30	0.53	9,405

(Ash) Theoretical ash of product
(VM) Adjusted value for volatile matters based on theoretical ash

TABLE WE-3

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS - DRY BASIS

Sample No.	% C	% H	% N	% Ash	% S	% O (diff)
WE-1	61.57	3.66	0.61	21.90	0.49	11.77
WE-2	54.76	3.51	0.66	26.87	0.49	13.71
WE-3	56.48	4.18	0.63	24.45	0.63	13.59
WE-10	60.45	3.87	0.65	20.66	0.45	13.92
WE-11	61.37	4.03	0.73	19.43	0.48	13.96
WE-12	57.85	4.42	0.61	25.70	0.68	10.74
WE-17	55.18	3.57	0.59	27.93	0.40	12.33
WE-18	60.20	3.72	0.71	19.40	0.51	15.46

TABLE WE-4

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS (AFTER ASH HAS BEEN ADJUSTED)

Sample No.	% C	% H	% N	% Ash	% S	% O (diff)
WE-1	62.97	3.74	0.62	20.13	0.50	12.04
WE-2	59.39	3.80	0.71	20.82	0.53	14.84
WE-3	58.34	4.32	0.65	21.96	0.65	14.08
WE-10	61.23	3.92	0.66	19.64	0.45	14.10
WE-11	60.70	3.98	0.72	20.31	0.47	13.82
WE-12	61.73	4.72	0.65	20.72	0.73	11.45
WE-17	61.09	3.95	0.65	20.20	0.44	13.67
WE-18	59.27	3.66	0.70	20.64	0.50	15.22

TABLE PD-1

SUMMARY OF EXPERIMENTAL RESULTS (PD SERIES)

	1/2" x 3/8" (S_1)			3/8" x 1/4" (S_2)			1/4" x 16 m (S_3)			
	L_1 (10 min)	L_2 (20 min)	L_3 (30 Min)	L_1	L_2	L_3	L_1	L_2	L_3	
T_1 (280°C)	4B	C6	7	1B	9	8	3B	5B	2	Run #
	279	279	281	286	279	279	286	282	293	Aver. Tempt.,°C
	84.7	85.0	83.1	88.2	87.7	82.5	91.3	93.5	99.7	Product Yield, %
	22.7	23.1	22.0	19.6	18.2	19.6	17.9	17.5	18.5	H_2O Recovered, %
	1.6	1.7	1.8	1.5	1.9	2.0	1.20	1.5	1.5	Gas Vol. (Litre)
	13.85	14.34	14.80	13.0	13.76	15.17	20.87	19.15	20.24	Residuum Content,%
T_2 (240°C)	10	17	16	11B	14	15		18	12	
	241	242	234	244	236	238		241	236	
	89.5	84.7	85.0	83.9	88.3	90.1		96.9	104.8	
	21.5	21.0	20.5	18.3	18.3	19.7		16.9	-	
	1.5	1.6	1.7	1.8	1.8	2.0		1.7	-	
	17.92	14.38	15.97	17.36	17.50	18.3		22.08	19.73	
T_3 (260°C)		19	20		21	22		23	24	
		262	263		262	263		266	263	
		92.2	88.4		89.6	91.0		94.2	95.7	
		20.0	21.2		16.9	18.5		16.0	17.0	
		-	-		-	-		-	-	
		17.89	14.85		14.94	19.27		17.69	19.28	

TABLE PD-2
PROXIMATE ANALYSIS, SULFUR, HEATING VALUE, AND RESIDUAL MOISTURE DETERMINATIONS ON UPGRADED PRODUCTS

Sample No.		RM%*	% H_2O	% Volatile Matter	% % Ash	% Fixed Carbon	S%*	BTU/lb*
PD-1B	As Received	0.15	.79	39.75 (40.26)	20.62 (19.61)	38.84	1.62	9,941
PD-2	As Received	1.28	.88	39.57 (39.14)	19.49 (20.36)	40.06	2.36	10,449
PD-3B	As Received	<0.1	.76	40.76 (40.89)	22.48 (22.23)	36.00	1.98	9,886
PD-4B	As Received	1.53	.80	40.55 (39.91)	17.12 (18.42)	41.53	1.46	10,231
PD-5B	As Received	1.14	.53	40.09 (40.80)	23.08 (21.71)	36.30	1.96	9,879
PD-6C	As Received	0.12	.93	41.29 (39.59)	14.84 (18.35)	42.94	1.55	10,688 10,644+
PD-7	As Received	<0.1	.72	39.78 (40.21)	19.65 (18.77)	39.85	2.95 2.83	10,305
PD-8	As Received	0.54	.84	39.37 (40.10)	22.41 (20.97)	37.38	1.61	9,890
PD-9	As Received	0.13	.85	39.24 (40.83)	22.86 (19.73)	37.05	1.41	9,763
PD-10	As Received	1.57	1.09	42.96 (41.83)	15.20 (17.43)	40.75	1.61	10,348
PD-11B	As Received	0.50	0.78	39.53 (40.67)	22.84 (20.62)	36.85	1.60	9,602
PD-12	As Received	0.55	0.85	43.61 (43.62)	19.40 (19.37)	35.14	2.37	10,556
PD-14	As Received	0.95	0.68	41.77 (40.68)	17.44 (19.59)	40.11	1.90	10,302
PD-15	As Received	0.82	0.68	40.91 (41.54)	20.44 (19.20)	37.97	1.92	10,076
PD-16	As Received	0.76	0.91	40.08 (41.71)	21.54 (18.35)	37.47	1.69 1.34+	9,732
PD-17	As Received	0.72	0.71	39.96 (41.18)	20.85 (18.42)	38.48	1.59	9,857
PD-18	As Received	0.60	1.16	41.37 (42.13)	22.38 (20.95)	35.09	2.23 1.88+	10,011
PD-19	As Received	0.74	1.75	42.63 (41.78)	15.24 (16.92)	40.38	1.69	10,786
PD-20	As Received	0.44	1.17	41.09 (40.92)	17.31 (17.65)	40.43	1.85 1.52+	10,508
PD-21	As Received	0.67	1.18	39.82 (39.77)	19.21 (19.31)	39.79	1.76	10,109
PD-22	As Received	0.34	.85	39.96 (41.31)	21.65 (19.01)	37.54	2.03 1.60+	10,111
PD-23	As Received	0.61	1.02	39.44 (39.72)	22.10 (21.55)	37.44	2.01	9,864
PD-24	As Received	0.42	1.10	39.24 (40.81)	24.25 (21.21)	35.41	2.41 1.88+	9,754

*Gulf R&D Department
+Check samples from subcontract laboratory
(Ash) - Theoretical Ash of product
(VM) - Adjusted value for volatile matters based on theoretical Ash.

TABLE PD-3

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS

Sample No.	% H_2O	% C	%* H	% N	% Ash	% S	%* O(diff)
PD-5B	0.11	58.12	3.80	0.63	23.63	1.73	11.98
PD-6C	0.33	63.83	4.08	0.80	15.32	1.23	14.41
PD-9	0.40	56.82	3.69	0.66	23.15	1.28	14.00
PD-14	0.68	60.72	4.27	0.75	17.44	1.90	14.24
PD-17	0.51	57.46	4.02	0.72	20.90	1.34	15.05
PD-18	0.69	57.87	4.03	0.73	21.03	1.88	13.77
PD-20	1.40	61.32	4.10	0.78	17.38	1.52	13.50
PD-22	1.34	58.26	3.91	0.72	21.52	1.60	12.62
PD-24	1.26	56.96	3.84	0.70	24.52	1.88	10.84

*Hydrogen and Oxygen do not include H and O in sample moisture.

TABLE PD-4

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS

(After Ash is Adjusted to Theoretical Value)

Sample No.	% H_2O	% C	%* H	% N	% Ash	% S	%* O(diff)
PD-5B	0.11	59.15	3.87	0.64	21.71	1.76	12.76
PD-6C	0.32	61.20	3.91	0.77	18.35	1.49	13.96
PD-9	0.42	59.12	3.84	0.69	19.73	1.47	14.73
PD-14	0.66	59.13	4.16	0.73	19.59	1.85	13.88
PD-17	0.53	59.22	4.14	0.74	18.42	1.74	15.21
PD-18	0.70	58.93	4.10	0.74	20.95	2.27	12.31
PD-20	1.39	61.06	4.08	0.77	17.65	1.51	13.54
PD-22	1.38	60.22	4.04	0.74	19.01	2.10	12.51
PD-24	1.31	59.24	3.99	0.73	21.21	1.95	11.57
Raw Coal (#5B,18,24)	17.77	44.96	2.31	0.55	20.29	0.73	13.39
Raw Coal (#6C,17,20)	21.09	44.86	2.16	0.47	15.55	0.55	15.32
Raw Coal (#9,14,22)	19.45	43.97	2.43	0.51	17.30	0.65	15.69

*Hydrogen and Oxygen do not include H and O in sample moisture.

TABLE PM-1
SUMMARY OF EXPERIMENTAL RESULTS (PM SERIES)

	1/2" x 3/8" (S_1)			3/8" x 1/4" (S_2)			1/4" x 16 m. (S_3)			
	L_1	L_2	L_3	L_1	L_2	L_3	L_1	L_2	L_3	
	7		4	8	2	5	9	3	6	Run #
T_1 (280°C)	274		282.1	282.2	275.9	280.1	282.9	285.0	282.7	Average Temp. (°C)
	87.9		85.2	88.8	84.2	87.8	94.6	91.1	89.5	Product Yield, %
	N/A		19.3	18.5	18.9	18.1	16.5	—	18.0	H_2O Recovered, %
	9.78		12.5	13.2	14.4	13.8	18.9	15.82	17.2	Residuum Content, %
	16	10	13	17	11	14		12	15	
T_2 (240°C)	240.1	244.5	237.6	241.4	246.5	239.5		247.2	241.4	
	90.6	89.7	90.6	94.0	95.7	91.4		99.6	98.4	
	20.7	20.6	20.8	18.8	18.9	18.9		16.5	17.7	
	10.03	10.9	14.2	13.7	16.70	11.91		21.5	20.3	
	25	19	22		20	23	27	21	24	
T_3 (320°C)	312.9	327.4	321.9		321.2	319.7	316.1	314.5	318.9	
	89.7	89.3	88.3		85.8	83.7	91.4	93.1	92.6	
	20.1	20.8	21.0		18.7	18.9	16.8	16.7	17.2	
	13.9	10.38	11.5		13.8	12.1	17.0	18.7	19.1	

TABLE PM-2
PROXIMATE ANALYSIS, SULFUR, HEATING VALUE AND RESIDUAL MOISTURE DETERMINATIONS ON UPGRADED PRODUCTS

Sample No.	RM %	% H_2O	% Volatile Matter	% Ash	% Fixed Carbon	S%*	BTU/lb*
PM-2	0.84	2.21	40.84 (39.52)	17.91 (20.55)	39.04	1.36 1.26+	10,259 10,297+
PM-3	0.60	1.15	40.01 (39.94)	22.16 (22.28)	36.68	1.48 1.46+	9,966 9,984+
PM-4	0.27	.92	40.65 (39.58)	16.11 (18.31)	42.32	1.27	10,402
PM-5	0.28	.93	40.27 (40.41)	19.97 (19.70)	38.83	1.29	10,085
PM-6	0.21	1.11	40.18 (39.79)	21.93 (22.68)	36.78	1.54	9,981
PM-7	0.13	1.78	39.14 (41.04)	21.56 (17.75)	37.52	1.25	9,544
PM-8	0.30	1.23	40.60 (39.93)	18.12 (19.48)	40.05	1.36	10,170
PM-9	1.46	2.35	41.54 (41.22)	20.85 (21.46)	35.26	1.47	10,120
PM-10	1.02	1.27	40.73 (42.47)	20.77 (17.39)	37.23	1.13 1.07+	9,610
PM-11	0.71	1.59	41.95 (43.85)	21.64 (18.08)	34.82	1.34 1.28+	9,750
PM-12	0.66	1.26	42.71 (43.35)	21.55 (20.38)	34.48	1.63 1.51+	9,970
PM-13	0.45	1.16	39.65 (43.91)	25.25 (17.22)	33.94	1.24	9,290
PM-14	0.55	1.18	40.24 (42.87)	23.91 (18.93)	34.67	1.18	9,355
PM-15	0.95	1.83	42.58 (43.18(	21.73 (20.63)	33.86	1.75	10,064
PM-16	0.88	1.69	44.18 (42.36)	13.66 (17.22)	40.47	1.25	10,396
PM-17	0.58	1.53	42.79 (42.55	17.94 (18.40)	37.74	1.39	10,157
PM-19	0.19	.84	37.84 (40.04)	22.01 (17.47)	39.31	1.25 1.33+	9,868
PM-20	0.45	1.52	39.34 (39.43)	20.35 (20.16)	38.79	1.33 1.35+	10,264
PM-21	0.99	1.82	40.45 (39.89)	20.70 (21.80)	37.03	1.49 1.44+	10,217
PM-22	0.08	1.07	39.88 (39.84)	17.58 (17.67)	41.47	1.31	10,526
PM-23	0.81	1.12	38.67 (38.97)	21.28 (20.67)	38.93	1.20	9,944
PM-24	1.02	1.29	39.56 (39.90)	22.59 (21.92)	36.56	1.65	10,161
PM-25	1.30	1.14	40.39 (42.34)	21.19 (17.39)	37.28	1.26	10,207
PM-27	1.43	1.65	40.24 (40.64)	22.98 (22.21)	35.13	1.63	10,006

* Gulf R&D Dept.
+ Check samples from Loring Laboratory
(Ash) Theoretical Ash of Product
(VM) Adjusted value for volatile matters based on theoretical ash

TABLE PM-3

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS

Sample No.	% H_2O	% C	% H*	% N	% Ash	% S	% O* (diff)
PM-2	1.67	59.98	4.06	.77	17.87	1.26	14.39
PM-3	1.35	57.75	3.99	.72	22.35	1.46	12.38
PM-10	1.90	56.75	4.12	.66	20.91	1.07	14.59
PM-11	2.11	55.50	3.68	.71	21.48	1.28	15.24
PM-12	1.48	57.43	4.01	.73	21.91	1.51	12.93
PM-19	1.16	57.45	3.80	.78	22.31	1.33	13.17
PM-20	1.30	60.09	4.18	.73	20.44	1.35	11.91
PM-21	1.55	60.66	4.12	.78	20.86	1.44	10.59

* Hydrogen and oxygen do not include H & O in sample moisture.

TABLE PM-4

ULTIMATE ANALYSIS OF UPGRADED PRODUCTS
(After Ash is Adjusted to Theoretical Value)

Sample No.	% H_2O	% C	% H*	% N	% Ash	% S	% O* (diff)
PM-2	1.62	58.04	3.93	0.75	20.55	1.21	13.90
PM-3	1.35	57.65	3.98	0.72	22.28	1.46	12.56
PM-10	1.98	59.17	4.29	0.69	17.39	1.12	15.36
PM-11	2.20	58.02	3.85	0.74	18.08	1.34	15.77
PM-12	1.50	58.28	4.07	0.74	20.38	1.53	13.50
PM-19	1.23	60.79	4.02	0.83	17.47	1.41	14.25
PM-20	1.30	60.23	4.19	0.73	20.16	1.35	12.04
PM-21	1.53	59.82	4.06	0.77	21.80	1.42	10.60
Raw Coal (#10,19)	21.09	44.86	2.16	0.47	15.55	0.55	15.32
Raw Coal (#2,11,20)	19.45	43.97	2.43	0.51	17.30	0.65	15.69
Raw Coal #3,12,21)	17.77	44.96	2.31	0.55	20.29	0.73	13.39

* Hydrogen and oxygen do not include H & O in sample moisture.

TABLE PE-1
SUMMARY OF EXPERIMENTAL RESULTS (PE SERIES)

	1/2" x 3/8" (S_1)				3/8" x 1/4" (S_2)				
	L_2*	L_2**	L_3*	L_3**	L_2*	L_2**	L_3*	L_3**	
T_1 (240°C)	1	2	3	4	5	6	7	8	Run #
	237.1	238.0	238.8	240.1	239.4	237.9	240.0	239.5	Average Temp. (°C)
	95.8	93.9	90.2	92.4	93.8	95.4	93.12	89.3	Product Yield, %
	13.90	17.43	17.20	14.40	17.73	17.51	15.37	17.92	Residuum Content, %
T_2 (280°C)	9	10			13	14	15	16	
	269.8	278.4			279.5	279.4	276.8	282.7	
	90.7	88.9			90.0	88.0	89.9	90.9	
	15.30	13.80			14.82	13.38	17.70	15.57	
T_3 (200°C)							19	20	
							201.3	200.4	
							89.6	87.9	
							17.35	17.07	

* 15 min. draining time
** 30 min. draining time

TABLE PE-2
PROXIMATE, SULFUR AND HEATING VALUES OF UPGRADED PRODUCTS

Sample No.	% H_2O	% Volatile Matter	% Ash	% Fixed Carbon	S %	BTU/lb
PE-1	3.49	40.08 (44.74)	20.31 (21.31)	36.12	0.83	9,157
PE-2	4.16	40.94 (43.55)	17.43 (18.19)	37.47	0.86	9,580
PE-3	4.01	41.21 (42.73)	15.61 (16.37)	39.17	0.92	9,592
PE-4	3.17	38.54 (43.64)	23.51 (24.26)	34.78	0.98	8,683
PE-5	4.69	38.80 (42.42)	21.02 (21.98)	35.49	1.0	8,936
PE-6	4.00	39.05 (42.79)	21.44 (22.30)	35.51	0.94	8,977
PE-7	3.17	39.52 (43.33)	21.25 (22.12)	36.06	0.91	8,986
PE-8	3.62	39.62 (42.56)	20.55 (21.49)	36.21	0.93	8,862
PE-9	3.25	40.85 (43.39)	16.36 (17.35)	39.54	0.84	9,536
PE-10	3.76	39.35 (41.66)	18.02 (18.73)	38.87	0.87	9,447
PE-13	3.10	39.37 (41.07)	17.98 (18.84)	39.55	0.91	9,475
PE-14	2.82	38.27 (41.27)	20.77 (21.81)	38.14	0.92	8,948
PE-15	3.39	39.39 (41.20)	18.64 (19.67)	38.58	0.94	9,326
PE-16	3.64	39.44 (40.94)	16.53 (17.48)	40.39	0.92	9,556
PE-19	3.51	40.24 (43.64)	20.44 (21.56)	35.81	0.94	8,813
PE-20	3.30	41.26 (43.02)	17.27 (18.31)	38.17	0.96	9,332

(Ash) Theoretical ash
(VM) Volatile matter content after ash has been adjusted to theoretical value.

TABLE 1

SUMMARY OF EXPERIMENTAL RESULTS

TD-RD-CD SERIES - TE-RE-CE SERIES

	TD		RD		CD		
	S_1*	S_2**	S_1	S_2	S_1	S_2	
240°C	TD-3	TD-4	RD-3	RD-4	CD-3	CD-4	Run #
	243.90	250.5	243.2	236.4	240.9	244.1	Average Temp. (°C)
	96.6	97.4	96.1	96.1	96.2	97.7	Product Yield, %
	5.1	5.2	7.2	7.4	6.9	6.0	H_2O Recovered, %
	7.89	7.88	10.0	7.88	9.50	7.9	Residuum Content, %
280°C	TD-1	TD-2	RD-2	RD-2	CD-1	CD-2	
	275.4	279.3	275.6	275.8	278.9	275.0	
	95.7	97.2	94.0	93.0	96.4	92.8	
	5.9	4.6	7.8	8.1	5.6	5.8	
	9.22	6.33	11.7	12.7	9.3	9.12	

	TE		RE		CE	
	S_1	S_2	S_1	S_2	S_1	S_2
240°C	TE-1	TE-2	RE-1	RE-2	CE-1	CE-2
	244.0	239.7	245.7	234.8	249.0	243.7
	97.7	96.8	95.3	96.1	95.7	97.0
	4.8	4.9	7.2	7.6	6.7	5.3
	11.6	7.67	7.41	6.86	10.66	9.55
280°C	TE-3	TE-4	RE-3	RE-4	CE-3	CE-4
	278.6	279.9	274.5	277.6	274.7	278.8
	96.3	96.7	94.2	93.8	95.9	96.7
	5.1	4.6	8.3	8.7	5.1	5.9
	7.46	8.04	7.54	7.45	10.65	8.57

All runs at 20 min. residence time.

* S_1 - 1/2" x 3/8"

** S_2 = 3/8" x 1/4"

TABLE 2 Continued

CE-RE-TE SERIES

Sample No.	Rec'd % H_2O	% H_2O	% Volatile Matter	% Ash	% Fixed Carbon	BTU/lb*
CE-1	1.53	1.84	34.77 (35.33)	10.75 (11.18)	52.64	12,069 (12,224)
CE-2	1.20	1.98	35.93 (37.04)	10.92 (11.03)	51.17	11,977 (12,309)
CE-3	1.70	1.17	36.65 (37.08)	11.01 (11.16)	51.17	12,018 (12,225)
CE-4	1.73	1.19	36.03 (36.41)	10.82 (11.07)	51.96	11,993 (12,186)
RE-1	3.55	1.79	38.97 (39.75)	10.66 (10.70)	48.58	10,515 (10,920)
RE-2	2.43	2.09	39.14 (40.66)	11.05 (9.78)	47.72	10,400 (10,840)
RE-3	2.40	2.13	38.56 (38.78)	9.20 (10.83)	50.11	10,837 (10,927)
RE-4	2.70	1.98	38.61 (39.41)	9.87 (10.02)	49.54	10,816 (11,131)
TE-1	1.35	1.31	27.94 (29.86)	35.58 (32.55)	35.17	7,928 (8,475)
TE-2	1.08	1.25	27.95 (29.40)	34.64 (32.64)	36.16	8,156 (8,555)
TE-3	1.69	1.07	26.80 (27.69)	34.09 (33.02)	38.04	8,208 (8,532)
TE-4	1.35	1.18	28.12 (28.26)	31.83 (32.68)	38.87	8,622 (8,678)

(Ash) Theoretical.
(VM) VM after ash adjusted to theoretical value.
(BTU) BTU after ash adjusted to theoretical value.

TABLE 2

TD-RD-CD SERIES

Sample No.	Rec'd % H_2O	% H_2O	% Volatile Matter	% Ash	% Fixed Carbon	BTU/lb*
CD-1	1.12	1.14	35.23	10.44	53.19	12,141
			(35.40)	(11.10)		(12,203)
CD-2	0.77	1.78	37.62	10.11	50.49	11,929
			(37.34)	(11.53)		(11,841)
CD-3	1.18	1.39	34.14	13.12	51.35	11,813
			(35.39)	(11.12)		(12,249)
CD-4	1.23	1.35	35.53	10.63	52.49	12,032
			(35.87)	(10.95)		(12,148)
RD-1	1.83	2.48	38.53	9.24	49.75	11,011
			(38.62)	(10.85)		(11,037)
RD-2	1.94	2.56	37.63	10.41	49.40	10,632
			(38.59)	(10.11)		(10,903)
RD-3	1.72	1.83	37.31	13.99	46.87	10,260
			(39.56)	(10.61)		(10,879)
RD-4	1.97	2.34	37.86	12.67	47.13	10,408
			(40.01)	(9.78)		(10,999)
TD-1	1.34	1.23	27.75	32.43	38.59	8,623
			(27.96)	(33.23)		(8,693)
TD-2	1.17	1.18	27.12	34.62	37.08	8,426
			(28.50)	(32.51)		(8,855)
TD-3	1.37	1.22	27.66	30.23	40.89	8,947
			(27.12)	(32.92)		(8,774)
TD-4	1.20	1.03	27.42	36.25	35.30	8,048
			(29.61)	(32.44)		(8,691)

(Ash) Theoretical.
(VM) VM after ash adjusted to theoretical value.
(BTU) BTU after ash adjusted to theoretical value.

TABLE TM/RM/CM-1 (TM, RM, CM, SERIES)

SUMMARY OF EXPERIMENTAL RESULTS

	Wapiti (T)		Roselyn (R)		Coal Valley (C)		
	S_1	S_2	S_1	S_2	S_1	S_2	
240°C	1A	2A	5A	6A	9A	10A	Run #
	244.7	239.2	238.4	239.2	240.5	240.2	Avg. Temperature
	96.2	97.7	94.4	95.4	95.6	96.7	% Yield
	5.4	5.1	7.0	6.9	4.9	4.9	Water %
	8.47	7.90	9.14	9.09	6.79	8.42	Residuum %
280°C	3A	4A	7A	8A	11A	12A	
	280.0	279.2	280.9	277.9	275.0	280.7	
	98.3	94.9	94.1	91.4	95.4	94.5	
	5.3	5.5	6.1	7.8	—	—	
	9.52	9.03	7.17	7.77	8.55	8.14	

All runs - 20 min. residence time, 30 min. draining time.

TABLE TM/RM/CM-2

PROXIMATE, SULFUR AND HEATING VALUES OF UPGRADED PRODUCTS

Sample No.	Rec'd % H_2O	% H_2O	% Volatile Matter	% Ash	% Fixed Carbon	% S	BTU/lb*
TM-1A	1.50	1.63	28.44 (28.78)	33.86 (33.06)	36.07	0.87	8,576 (8,754)
TM-2A	1.38	1.45	27.83 (29.11)	35.34 (32.35)	35.38	0.92	8,402 (8,863)
TM-3A	1.05	1.29	28.85 (28.15)	30.66 (32.35)	39.20	0.91	9,024 (8,855)
TM-4A	1.17	1.43	28.31 (27.54)	31.13 (33.00)	39.13	0.91	8,878 (8,654)
RM-5A	2.67	2.78	39.15 (39.72)	12.10 (10.81)	45.97	1.13	10,938 (11,142)
RM-6A	2.90	3.10	39.54 (40.19)	11.31 (9.85)	46.05	1.19	10,967 (11,192)
RM-7A	2.20	2.41	38.75 (39.66)	12.89 (10.84)	45.95	1.18	10,872 (11,169)
RM-8A	2.37	2.00	39.73 (39.68)	10.17 (10.28)	48.10	1.13	11,102 (11,113)
CM-9A	1.62	2.00	36.84 (36.46)	10.26 (11.19)	50.90	0.60	12,277 (12,176)
CM-10A	1.40	1.85	36.13 (36.09)	10.96 (11.07)	51.06	0.71	12,217 (12,230)
CM-11A	1.32	1.58	36.60 (36.27)	10.40 (11.22)	51.42	0.63	12,210 (12,119)
CM-12A	1.32	1.60	35.82 (35.55)	10.64 (11.32)	51.94	0.73	12,149 (12,079)

(Ash) Theoretical.
(VM) VM after ash adjusted to theoretical value.
(BTU) BTU after ash adjusted to theoretical value.

TABLE TE-A/RE-A/CE-A-1

SUMMARY OF EXPERIMENTAL RESULTS

	Wapiti (T)		Roselyn (R)		Coal Valley (C)		
	S_1	S_2	S_1	S_2	S_1	S_2	
240°C	1A	2A	5A	6A	9A	10A	Run #
	241	239	241.5	240.6	240	240.2	Avg. Temperature
	97.0	96.6	92.8	94.7	95.9	96.4	% Yield
	4.99	4.88	7.16	7.16	5.07	—	Water %
	7.39	6.87	7.77	8.50	6.57	6.80	Residuum %
280°C	3A	4A	7A	8A	11A	121A	
	279.8	280.4	278.8	278.1	279.1	278.6	
	94.5	94.6	92.9	93.3	95.8	95.5	
	—	—	7.05	7.05	5.17	5.10	
	6.43	7.59	7.50	8.29	6.41	6.74	

All runs - 20 min. residence time, 30 min. draining time.

TABLE TE-A/RE-A/CE-A-2

PROXIMATE AND HEATING VALUES OF UPGRADED PRODUCTS (DRY BASIS)

Sample No.	% VCL Matter	% Ash	% Fixed Carbon	BTU/lb.
TE-1A	28.05	35.22	36.73	8,197
	(29.11)	(32.78)		(8,505)
TE-2A	27.98	36.32	35.70	7,866
	(29.57)	(32.71)		(8,311)
TE-3A	29.45	29.21	41.34	9,298
	(27.60)	(33.65)		(8,714)
TE-4A	29.78	31.50	38.72	8,857
	(28.95)	(33.40)		(8,611)
RE-5A	38.90	15.71	45.39	10,269
	(41.08)	(10.99)		(10,844)
RE-6A	39.94	12.59	47.47	10,627
	(41.16)	(9.93)		(10,950)
RE-7A	38.66	13.98	47.36	10,624
	(40.00)	(10.98)		(10,994)
RE-8A	40.28	10.40	49.32	11,024
	(40.42)	(10.08)		(11,063)
CE-9A	37.42	9.40	53.18	12,213
	(36.69)	(11.16)		(11,975)
CE-10A	35.70	11.82	52.48	11,871
	(35.99)	(11.10)		(11,967)
CE-11A	36.48	10.60	52.92	12,053
	(36.24)	(11.17)		(11,976)
CE-12A	36.48	11.02	52.50	11,972
	(36.41)	(11.20)		(11,947)

(Ash) Theoretical value
(VM) VM after ash has been adjusted to theoretical ash level
(BTU) BTU after ash has been adjusted to theoretical ash level

```
                    D A T A   C H E C K I N G

                              W2-D-1


                  *       YIELD%     YIELD%
                        (PRODUCT)  (UPG COAL)

                           90.90       84.89


                 **        RES%       RES%
                          (DETN)   (CAL FROM S)

                           6.61     (SULFUR NOT ANALYZED)


                ***     ASH%     ASH%     ASH%
                      (DETN)    (CAL)   (CAL-UC)

                        22.47    21.34   22.85


        ****        BTU         BTU        BTU        BTU        BTU
                   (DETN)      (DETN)     (CAL)      (CAL)      (COAL)
                   (MAF)                             (ADJ)      (MAF)

                   12614        9780       9933       9791      12076


        *****       BTU RE      BTU RE       BTU RE     BTU RE
                    -----PRODUCT-----        -----UPG COAL-----
                                (ADJ)                   (ADJ)
                    107.47      109.03        94.89      96.27



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W3-D-2

```
*          YIELD%     YIELD%
         (PRODUCT)  (UPG COAL)

           98.80       84.81


**         RES%       RES%
          (DETN)   (CAL FROM S)

          14.16     (SULFUR NOT ANALYZED)


***     ASH%     ASH%      ASH%
       (DETN)   (CAL)    (CAL-UC)

        23.99   22.27    25.94


****         BTU         BTU          BTU          BTU          BTU
            (DETN)      (DETN)       (CAL)        (CAL)        (COAL)
            (MAF)                                 (ADJ)         (MAF)

            13061        9928        10170         9944         11974


*****        BTU RE       BTU RE         BTU RE       BTU RE
             -----PRODUCT-----           -----UPG COAL-----
                          (ADJ)                       (ADJ)
             123.35       126.35          93.04        95.15


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA  CHECKING

                              W2-D-3


                  *       YIELD%    YIELD%
                        (PRODUCT)  (UPG COAL)

                           91.70      84.69


                 **        RES%       RES%
                          (DETN)   (CAL FROM S)

                            7.64       8.10

                ***     ASH%     ASH%     ASH%
                       (DETN)   (CAL)    (CAL-UC)

                        15.97   21.16    22.91


      ****         BTU        BTU        BTU        BTU        BTU
                  (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
                  (MAF)                            (ADJ)      (MAF)

                  12537      10535      10015      10673      12076


      *****       BTU RE      BTU RE       BTU RE      BTU RE
                  -----PRODUCT-----        -----UPG COAL-----
                              (ADJ)                    (ADJ)
                  116.79      109.58       102.12       95.82



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                         W1-D-4


           *         YIELD%    YIELD%
                   (PRODUCT)  (UPG COAL

                     90.00       84.12


          **         RES%       RES%
                    (DETN)   (CAL FROM S)

                      6.53    (SULFUR NOT ANALYZED)


         ***      ASH%     ASH%     ASH%
                 (DETN)   (CAL)    (CAL-UC

                  22.75    20.56    21.99


   ****        BTU         BTU         BTU         BTU         BTU
              (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
              (MAF)                               (ADJ)       (MAF)

              12773        9967       10140        9860       12212


   *****       BTU RE      BTU RE         BTU RE      BTU RE
              -----PRODUCT-----          -----UPG COAL-----
                           (ADJ)                      (ADJ)
              104.93      107.91          92.81       95.55




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                      W1-D-E


         *          YIELD%     YIELD%
                  (PRODUCT)  (UPG COAL)

                    90.40       95.26


        **          REC%       REC%
                    DETN)   (CAL FROM S)

                    5.02     (SULFUR NOT ANALYZED


       ***       ASH%     ASH%     ASH%
                (DETN)   (CAL)   (CAL-UC)

                 16.78    20.46    11.55


 ****        BTU         BTU        BTU        BTU         BTU
            (DETN)      DETN)      (CAL)      (CAL)      (COAL)
            (MAF)                             (ADJ)      (MAF)

             12612       10546      10024      10579       12212


 *****       BTU RE      BTU RE        BTU RE      BTU RE
             -----PRODUCT-----         -----UPG COAL-----
                         (ADJ                    ADJ
             110.55      107.15        107.76      95.02


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                              W2-D-6


              *          YIELD%    YIELD%
                       (PRODUCT)  (UPG COAL)

                          87.10       92.77


             **          RES%       RES%
                        (DETN)   (CAL FROM S)

                          4.97     (SULFUR NOT ANALYZED)


            ***      ASH%     ASH%      ASH%
                    (DETN)   (CAL)    (CAL-UC)

                     24.20    22.27    23.44


    ****        BTU         BTU         BTU         BTU         BTU
               (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
               (MAF)                               (ADJ)       (MAF)

               12703        9629        9804        9561       12076


    *****      BTU RE      BTU RE        BTU RE      BTU RE
               -----PRODUCT-----         -----UPG COAL-----
                           (ADJ)                     (ADJ)
               101.39      103.97        92.33       94.67



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA CHECKING

                        W1-D-7


          *        YIELD%    YIELD%
                  (PRODUCT)  (UPG COAL)

                   87.80      84.00


         **         RES%       RES%
                   (DETN)   (CAL FROM S)

                    4.33        5.77

        ***      ASH%     ASH%     ASH%
                (DETN)   (CAL)   (CAL-UC

                 22.70   21.07   22.02

 ****        BTU         BTU         BTU         BTU         BTU
            (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
            (MAF)                               (ADJ)       (MAF)

            12790        9887        9971        9766        12212


 *****       BTU RE      BTU RE       BTU RE      BTU RE
             -----PRODUCT-----        -----UPG COAL-----
                         (ADJ)                    (ADJ)
             102.37      104.74        94.79       96.79




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W3-D-8

```
          *        YIELD%      YIELD%
                 (PRODUCT)   (UPG COAL)

                   95.20       85.44


         **        RES%        RES%
                  (DETN)    (CAL FROM S)

                   10.28       10.49


        ***     ASH%     ASH%      ASH%
               (DETN)   (CAL)    (CAL-UC)

                24.71    23.11     25.75


****        BTU         BTU        BTU        BTU        BTU
           (DETN)      (DETN)     (CAL)      (CAL)      (COAL)
           (MAF)                             (ADJ)      (MAF)

           12974        9768       9844       9639      11974


*****      BTU RE      BTU RE        BTU RE     BTU RE
           -----PRODUCT-----         -----UPG COAL-----
                       (ADJ)                    (ADJ)
           117.17      119.62         95.85      97.89




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                         W3-D-9


            *          YIELD%     YIELD%
                     (PRODUCT)   (UPG COAL)

                       96.00        84.94


           **          RES%        RES%
                       (DETN)    (CAL FROM S)

                       11.52      (SULFUR NOT ANALYZED)


          ***      ASH%      ASH%      ASH%
                  (DETN)    (CAL)     (CAL-UC)

                   23.68     22.92     25.90


 ****         BTU          BTU          BTU          BTU          BTU
             (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
             (MAF)                                  (ADJ)        (MAF)

             12757         9481         9950         9593        11974


 *****        BTU RE       BTU RE          BTU RE       BTU RE
              -----PRODUCT-----            -----UPG COAL-----
                           (ADJ)                        (ADJ)
              114.65       118.91          90.52        93.89



 (UPG COAL)---THE COAL PORTION OF THE PRODUCT
 (DETN)---FROM ACTUAL DETERMINATION
 (CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
 (CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
 (MAF)---MOISTURE ASH FREE BASIS
 (ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
 BTU RE---BTU RECOVERY
```

DATA CHECKING

W2-D-10

```
                      *         YIELD%    YIELD%
                              (PRODUCT)  (UPG COAL)

                                 90.80      96.13


                     **          RES%      RES%
                                (DETN)   (CAL FROM S)

                                  5.14     (SULFUR NOT ANALYZED)


                    ***      ASH%     ASH%     ASH%
                            (DETN)   (CAL)    (CAL-UC)

                             20.35    21.37    22.52


         ****        BTU          BTU         BTU         BTU         BTU
                    (DETN)       (DETN)      (CAL)       (CAL)       (COAL)
                    (MAF)                                (ADJ)        (MAF)

                    12031        10379        9817        9944        12076


         *****       BTU RE      BTU RE        BTU RE      BTU RE
                     ------PRODUCT-----        -----UPG COAL-----
                                  (ADJ)                    (ADJ)
                     113.93      112.48        104.16      102.83



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                              DATA  CHECKING

                                    W3-D-11


                           *         YIELD%    YIELD%
                                   (PRODUCT)  (UPG COAL)

                                     95.70       96.02


                          **         RES%      RES%
                                    (DETN)  (CAL FROM S)

                                     10.12       10.32

                         ***      ASH%     ASH%     ASH%
                                 (DETN)   (CAL)    (CAL-UC)

                                 24.88    22.99    25.58

                ****       BTU        BTU        BTU         BTU        BTU
                          (DETN)     (DETN)     (CAL)       (CAL)      (COAL)
                          (MAF)                             (ADJ)      (MAF)

                          13360      10036      9833        9592       11974


                *****      BTU RE      BTU RE       BTU RE      BTU RE
                           -----PRODUCT-----        -----UPG COAL-----
                                       (ADJ)                     (ADJ)
                           120.98      124.02       99.85       102.37



       (UPG COAL)---THE COAL PORTION OF THE PRODUCT
       (DETN)---FROM ACTUAL DETERMINATION
       (CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
       (CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
       (MAF)---MOISTURE ASH FREE BASIS
       (ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
       BTU RE---BTU RECOVERY
```

DATA CHECKING

W3-D-12

```
  *         YIELD%     YIELD%
          (PRODUCT)   (UPG COAL)

            95.60        79.81

 **         RES%        RES%
            (DETN)   (CAL FROM S)

            16.52     (SULFUR NOT ANALYZED)

***       ASH%      ASH%      ASH%
         (DETN)    (CAL)     (CAL-UC)

          27.25     23.01     27.57

****          BTU          BTU          BTU          BTU          BTU
             (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
             (MAF)                                  (ADJ)         (MAF)

             13626         9913        10366         9796        11974


*****        BTU RE      BTU RE        BTU RE       BTU RE
             -----PRODUCT-----         -----UPG COAL-----
                         (ADJ)                      (ADJ)
             119.37      126.32        84.92        89.87



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                        W1-D-12


             *         YIELD%    YIELD%
                     (PRODUCT)  (UPG COAL)

                        92.50      96.15


            **          RES%       RES%
                       (DETN)   (CAL FROM S)

                         6.96       5.22

           ***      ASH%     ASH%      ASH%
                   (DETN)   (CAL)    (CAL-UC)

                   20.68    20.00     21.47


    ****       BTU         BTU         BTU         BTU        BTU
              (DETN)      (DETN)      (CAL)       (CAL)      (COAL)
              (MAF)                               (ADJ)      (MAF)

              12414        9947       10166       10079      12212


   *****     BTU RE      BTU RE        BTU RE      BTU RE
             -----PRODUCT-----         -----UPG COAL-----
                          (ADJ)                     (ADJ)
             107.63      108.55         94.64       95.45



(UPG COAL)----THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)----MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                              W2-D-14


             *          YIELD%     YIELD%
                      (PRODUCT)  (UPG COAL)

                         91.40       94.05


            **          RES%       RES%
                       (DETN)   (CAL FROM S)

                         8.04     (SULFUR NOT ANALYZED)


           ***       ASH%     ASH%     ASH%
                    (DETN)   (CAL)   (CAL-UC)

                    23.15    21.23    23.08


 ****           BTU          BTU          BTU          BTU          BTU
               (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
               (MAF)                                  (ADJ)        (MAF)

               12229         9398        10046         9801        12076


 *****          BTU RE       BTU RE          BTU RE      BTU RE
               -----PRODUCT-----             -----UPG COAL-----
                             (ADJ)                         (ADJ)
               103.84       106.44           98.46        90.67



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTL RECOVERY
```

```
                        DATA  CHECKING

                           W3-D-15


                 *          YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                             95.70      82.68


                **          RES%       RES%
                            (DETN)   (CAL FROM S)

                             13.60     (SULFUR NOT ANALYZED)


               ***       ASH%     ASH%     ASH%
                        (DETN)   (CAL)    (CAL-UC)

                         25.66    22.99    26.61


       ****          BTU         BTU         BTU         BTU         BTU
                    (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                    (MAF)                               (ADJ)        (MAF)

                    12074        8976       10123        9772        11974


       *****        BTU RE      BTU RE         BTU RE      BTU RE
                    -----PRODUCT-----          -----UPG COAL-----
                                 (ADJ)                       (ADJ)
                    108.20      112.09          79.81       82.68



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                      W1-D-16


      *         YIELD%     YIELD%
              (PRODUCT)   (UPG COAL)

                 91.60       36.30


     **          RES%        RES%
                (DETN)    (CAL FROM S)

                  5.79     (SULFUR NOT ANALYZED)


    ***        ASH%      ASH%      ASH%

             (DETN)    (CAL)     (CAL-UC)

               24.82    30.30    21.44


****          BTU         BTU         BTU         BTU         BTU
             (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
             (MAF)                               (ADJ)       (MAF)

             10146        9131       10083        9499        12212


*****        BTU RE      BTU RE        BTU RE      BTU RE
             ------PRODUCT-----        -----UPG COAL-----
                         (ADJ)                     (ADJ
              98.33      104.91         87.89       93.39



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W2-D-17

```
        *          YIELD%      YIELD%
                 (PRODUCT)   (UPG COAL)

                   92.50       87.00


       **          RES%        RES%
                  (DETN)    (CAL FROM S)

                   5.95         6.41


      ***      ASH%     ASH%      ASH%
              (DETN)   (CAL)    (CAL-UC)

              21.10    20.97     22.30


****       BTU          BTU          BTU          BTU          BTU
          (DETN)       (DETN)       (CAL)        (CAL)       (COAL)
          (MAF)                                  (ADJ)        (MAF)

          12679        10004        9881         9865         12076


*****     BTU RE       BTU RE         BTU RE       BTU RE
          -----PRODUCT-----           -----UPG COAL-----
                       (ADJ)                       (ADJ)
          111.87       112.05         100.35       100.51


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA CHECKING

                       W1-D-18


           *       YIELD%    YIELD%
                 (PRODUCT)  (UPG COAL)

                   91.10      85.47


          **        RES%       RES%
                   (DETN)  (CAL FROM S)

                    6.18     (SULFUR NOT ANALYZED)


         ***     ASH%     ASH%     ASH%
                (DETN)   (CAL)    (CAL-UC)

                 19.96    20.31    21.65


   ****        BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
              (MAF)                            (ADJ)      (MAF)

              12780      10229      10113      10157      12212


   *****      BTU RE      BTU RE       BTU RE     BTU RE
              -----PRODUCT-----        -----UPG COAL-----
                          (ADJ)                   (ADJ)
              110.11      109.63       98.39      99.16



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                        DATA  CHECKING

                             W2-D-19


                  *         YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                            92.70       84.51


                 **          RES%       RES%
                            (DETN)   (CAL FROM S)

                             8.84     (SULFUR NOT ANALYZED)


                ***       ASH%     ASH%      ASH%
                        (DETN)   (CAL)     (CAL-UC)

                          21.10    20.93    22.96


        ****        BTU          BTU          BTU         BTU         BTU
                  (DETN)       (DETN)       (CAL)       (CAL)       (COAL)
                  (MAF)                                 (ADJ)        (MAF)

                  12795        10095        10110       10087       12076


        *****     BTU RE      BTU RE         BTU RE      BTU RE
                  -----PRODUCT-----          -----UPG COAL-----
                               (ADJ)                      (ADJ)
                  113.13      113.38          95.98       96.18


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                          W3-D-20

             *        YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      94.60       84.54

            **        RES%        RES%
                     (DETN)   (CAL FROM S)

                      10.63     (SULFUR NOT ANALYZED)

           ***     ASH%     ASH%      ASH%
                 (DETN)   (CAL)     (CAL-UC)

                  24.73    23.26     26.02

  ****        BTU        BTU        BTU        BTU        BTU
             (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
             (MAF)                            (ADJ)      (MAF)

             13100       9860       9676       9686       11974


  *****      BTU RE      BTU RE         BTU RE      BTU RE
             ------PRODUCT-----         -----UPG COAL-----
                         (ADJ)                      (ADJ)
             117.49      119.79          95.56       97.43


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                              W2-D-21


                   *          YIELD%     YIELD%
                           (PRODUCT)  (UPG COAL)

                              93.10       94.29


                  **          RES%       RES%
                             (DETN)   (CAL FROM S)

                              9.46     (SULFUR NOT ANALYZED)


                 ***       ASH%     ASH%     ASH%
                         (DETN)   (CAL)    (CAL-UC)

                          19.49    20.84    23.02


        ****      BTU        BTU        BTU        BTU        BTU
                 (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                 (MAF)                            (ADJ)       (MAF)

                 13078      10529      10159      10331      12076


        *****     BTU RE      BTU RE       BTU RE      BTU RE
                  -----PRODUCT-----        -----UPG COAL-----
                              (ADJ)                    (ADJ)
                  118.50      116.52       100.07       98.39



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA CHECKING

                         W1-D-22


          *         YIELD%    YIELD%
                  (PRODUCT)  (UPG COAL)

                    91.20       83.42


         **          RES%       RES%
                    (DETN)   (CAL FROM S)

                     9.53     (SULFUR NOT ANALYZED)


        ***       ASH%    ASH%     ASH%
                 (DETN)   (CAL)   (CAL-UC)

                  19.73   20.29   22.18


 ****            BTU        BTU        BTU        BTU        BTU
                (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                (MAF)                            (ADJ)       (MAF)

                 12952      10526      10294      10495      12212


 *****           BTU RE      BTU RE       BTU RE      BTU RE
                 -----PRODUCT-----        -----UPG COAL-----
                              (ADJ)                   (ADJ)
                 113.43      111.26        97.51       95.65



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                          W3-D-23


                *          YIELD%    YIELD%
                         (PRODUCT)  (UPG COAL)

                           96.20       78.66


               **          RES%       RES%
                          (DETN)   (CAL FROM S)

                          18.23     (SULFUR NOT ANALYZED)


              ***     ASH%     ASH%     ASH%
                    (DETN)   (CAL)    (CAL-UC)

                     25.20    22.87    27.97


         ****        BTU          BTU         BTU         BTU         BTU
                    (DETN)       (DETN)      (CAL)       (CAL)      (COAL)
                    (MAF)                                (ADJ)       (MAF)

                    13175         9855       10509       10191       11974


         *****      BTU RE      BTU RE        BTU RE      BTU RE
                    -----PRODUCT-----        -----UPG COAL-----
                                 (ADJ)                    (ADJ)
                    119.42      123.14        81.17       83.70



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W3-D-24

```
   *         YIELD%    YIELD%
           (PRODUCT)  (UPG COAL)

             95.10       79.41


  **         RES%       RES%
            (DETN)   (CAL FROM S)

            16.50     (SULFUR NOT ANALYZED)


 ***     ASH%     ASH%      ASH%
        (DETN)   (CAL)    (CAL-UC)

        23.60    23.13     27.70


****          BTU        BTU        BTU        BTU        BTU
            (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
            (MAF)                            (ADJ)      (MAF)

            13257      10128      10365      10302      11974


*****       BTU RE     BTU RE         BTU RE     BTU RE
            -----PRODUCT-----         -----UPG COAL-----
                       (ADJ)                     (ADJ)
            121.32     122.06          87.10      87.63



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                         W1-D-25


          *          YIELD%     YIELD%
                    (PRODUCT)   (UPG COAL)

                      89.40       93.54


          **          RES%        RES%
                     (DETN)    (CAL FROM S)

                       6.55     (SULFUR NOT ANALYZED)


         ***      ASH%      ASH%      ASH%
                 (DETN)    (CAL)    (CAL-UC)

                  18.31    20.69     22.14


****          BTU          BTU          BTU          BTU          BTU
             (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
             (MAF)                                  (ADJ)         (MAF)

              13019        10635        10142        10447        12212


*****         BTU RE       BTU RE           BTU RE       BTU RE
              -----PRODUCT-----             -----UPG COAL-----
                           (ADJ)                         (ADJ)
              112.34       109.07           100.36        97.43



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W1-D-26

```
 *          YIELD%      YIELD%
          (PRODUCT)   (UPG COAL)

            91.90       85.04


**          RES%       RES%
           (DETN)   (CAL FROM S)

            7.46        7.25

***       ASH%     ASH%      ASH%
         (DETN)   (CAL)    (CAL-UC)

          28.49    20.13    21.75


****         BTU         BTU         BTU         BTU         BTU
            (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
            (MAF)                               (ADJ)        (MAF)

            12443        8898       10212        9143       12212


*****       BTU RE      BTU RE        BTU RE      BTU RE
            -----PRODUCT-----         -----UPG COAL-----
                        (ADJ)                      (ADJ)
             96.62      107.92        82.60        92.25


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W2-D-27

```
          *          YIELD%     YIELD%
                   (PRODUCT)  (UPG COAL)

                     91.70      86.59


         **          RES%       RES%
                    (DETN)   (CAL FROM S)

                     5.57        7.09

        ***       ASH%     ASH%     ASH%
                 (DETN)   (CAL)   (CAL--UC)

                  22.74   21.16    22.40


****       BTU        BTU        BTU        BTU        BTU
          (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
          (MAF)                            (ADJ)       (MAF)

          12885       9955       9851       9653       12076


*****      BTU RE      BTU RE        BTU RE     BTU RE
          -----PRODUCT-----          -----UPG COAL-----
                        (ADJ)                    (ADJ)
          110.36      112.62          99.66      101.71



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                     DATA  CHECKING

                         W2-M-1


          *         YIELD%     YIELD%
                  (PRODUCT)  (UPG COAL)

                    90.60       96.14


         **         RES%       RES%
                   (DETN)   (CAL FROM S)

                     4.92        5.29

        ***      ASH%     ASH%     ASH%
                (DETN)   (CAL)   (CAL-UC)

                 23.65    21.41    22.52


****        BTU        BTU        BTU        BTU        BTU
           (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
           (MAF)                            (ADJ)       (MAF)

           12389       9459       9807       9528      12076


*****      BTU RE     BTU RE       BTU RE      BTU RE
           -----PRODUCT-----       -----UPG COAL-----
                      (ADJ)                    (ADJ)
           103.60     106.64       94.19       96.94


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA CHECKING

                       W2-M-2


              *       YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      91.70      85.85


             **       RES%      RES%
                      (DETN)  (CAL FROM S)

                       6.38       4.40

            ***    ASH%     ASH%     ASH%
                  (DETN)   (CAL)   (CAL-UC)

                   23.99   21.16    22.60

    ****      BTU       BTU       BTU       BTU       BTU
             (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
             (MAF)                         (ADJ)     (MAF)

             12684      9641      9925      9568     12076


    *****     BTU RE    BTU RE      BTU RE    BTU RE
              -----PRODUCT-----     -----UPG COAL-----
                        (ADJ)                 (ADJ)
              106.88    110.86      94.52     98.04


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                              W2-M-3


                 *          YIELD%     YIELD%
                          (PRODUCT)  (UPG COAL)

                            89.60      82.35


                **          RES%       RES%
                           (DETN)   (CAL FROM S)

                            8.09        6.00

               ***     ASH%      ASH%      ASH%
                      (DETN)    (CAL)    (CAL-UC)

                      20.15     21.65     23.56


     ****        BTU        BTU        BTU        BTU        BTU
                (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                (MAF)                            (ADJ)      (MAF)

                12550      10021      10063      10256      12076


     *****       BTU RE     BTU RE        BTU RE     BTU RE
                -----PRODUCT-----         -----UPG COAL-----
                            (ADJ)                    (ADJ)
                108.54     106.50         93.23      91.48


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W1-M-4

```
                 *         YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                            99.40      96.82


                **          RES%      RES%
                           (DETN)   (CAL FROM S)

                            2.89        3.69

               ***     ASH%     ASH%     ASH%
                      (DETN)   (CAL)   (CAL-UC)

                       22.47   20.69    21.31


      ****        BTU        BTU        BTU        BTU        BTU
                 (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                 (MAF)                            (ADJ)      (MAF)

                 12426       9634       9865       9644      12212


      *****      BTU RE     BTU RE      BTU RE     BTU RE
                 -----PRODUCT-----      -----UPG COAL-----
                            (ADJ)                  (ADJ)
                 101.77     104.10      96.44      98.65



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                        W1-M-5


            *         YIELD%     YIELD%
                    (PRODUCT)   (UPG COAL)

                      90.00       86.56


           **         RES%        RES%
                     (DETN)   (CAL FROM S)

                      3.82         4.93

          ***     ASH%      ASH%      ASH%
                 (DETN)    (CAL)    (CAL-UC)

                  19.39    20.56     21.37


  ****        BTU         BTU         BTU         BTU         BTU
             (DETN)      (DETN)      (CAL)       (CAL)      (COAL)
             (MAF)                               (ADJ)       (MAF)

             12719       10253        9938       10084       12212


  *****      BTU RE      BTU RE          BTU RE      BTU RE
             -----PRODUCT-----           -----UPG COAL-----
                          (ADJ)                      (ADJ)
             109.04      107.46          101.94      100.46



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA  CHECKING

                              W1-M-6


                  *        YIELD%     YIELD%
                         (PRODUCT)  (UPG COAL)

                           89.30        95.43


                 **        RES%        RES%
                          (DETN)   (CAL FROM S)

                           4.33        5.10

                ***     ASH%      ASH%      ASH%
                       (DETN)    (CAL)    (CAL-UC)

                        19.19     20.72     21.65

          ****      BTU         BTU         BTU        BTU        BTU
                   (DETN)      (DETN)      (CAL)      (CAL)     (COAL)
                   (MAF)                              (ADJ)      (MAF)

                   12558       10148       9978       10170      12212


          *****    BTU RE      BTU RE       BTU RE      BTU RE
                   -----PRODUCT-----        -----UPG COAL-----
                                (ADJ)                     (ADJ)
                   107.08      105.06       99.10       97.22



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                          W3-M-7


                  *         YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                            90.20       80.64


                 **         RES%        RES%
                           (DETN)   (CAL FROM S)

                            10.60       10.80

                ***      ASH%     ASH%      ASH%
                        (DETN)   (CAL)    (CAL--UC)

                         32.97    24.39    27.28


      ****      BTU         BTU        BTU        BTU        BTU
               (DETN)      (DETN)     (CAL)      (CAL)      (COAL)
               (MAF)                             (ADJ)       (MAF)

               12748        9820       9890      10076      11974


      *****    BTU RE      BTU RE       BTU RE      BTU RE
               -----PRODUCT-----        -----UPG COAL-----
                           (ADJ)                    (ADJ)
               111.57      109.51       90.53       98.96



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W3-M-B

```
            *        YIELD%     YIELD%
                   (PRODUCT)  (UPG COAL)

                     97.10       86.22

           **        RES%       RES%
                    (DETN)   (CAL FROM S)

                     11.20       12.04

          ***      ASH%     ASH%      ASH%
                 (DETN)   (CAL)    (CAL--UC)

                  23.58    22.66     25.51

****     BTU         BTU         BTU         BTU         BTU
        (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
        (MAF)                               (ADJ)        (MAF)

        13048        9971        9941        9822        11974

*****    BTU RE       BTU RE         BTU RE       BTU RE
        -----PRODUCT-----           -----UPG COAL-----
                      (ADJ)                       (ADJ)
        121.95       123.43          98.02        99.20

(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                                W3-M-9

                   *          YIELD%     YIELD%
                            (PRODUCT)  (UPG COAL)

                              93.20       83.96

                  **          RES%       RES%
                             (DETN)   (CAL FROM S)

                              9.91       10.62

                 ***    ASH%      ASH%      ASH%
                      (DETN)     (CAL)    (CAL-UC)

                        22.34     23.61     26.20

        ****       BTU        BTU        BTU        BTU        BTU
                 (DETN)     (DETN)      (CAL)      (CAL)     (COAL)
                  (MAF)                            (ADJ)      (MAF)

                  12904      10021       9832       9994      11974

        *****    BTU RE     BTU RE      BTU RE     BTU RE
                 -----PRODUCT-----      -----UPG COAL-----
                             (ADJ)                 (ADJ)
                 117.64     115.73      97.31      95.73

(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE-ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                          W2-M-10


                 *       YIELD%     YIELD%
                       (PRODUCT)  (UPG COAL)

                          89.00      85.49


                **        RES%       RES%
                         (DETN)   (CAL FROM S)

                          3.94        4.05

               ***     ASH%     ASH%     ASH%
                      (DETN)   (CAL)   (CAL-UC)

                       29.25    21.80    22.69


  ****        BTU        BTU        BTU        BTU        BTU
             (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
             (MAF)                            (ADJ)       (MAF)

             12430       8794       9728       8801       12076


  *****      BTU RE      BTU RE      BTU RE      BTU RE
             -----PRODUCT-----       -----UPG COAL-----
                          (ADJ)                   (ADJ)
              94.62      104.58       87.21       96.40


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA  CHECKING

                            W2-M-11


                 *          YIELD%     YIELD%
                          (PRODUCT)  (UPG COAL)

                            95.90       89.38


                **          RES%       RES%
                           (DETN)   (CAL FROM S)

                            6.80         7.41

               ***      ASH%      ASH%      ASH%
                       (DETN)    (CAL)    (CAL-UC)

                        20.29     20.23     21.71


     ****         BTU         BTU         BTU         BTU         BTU
                 (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                 (MAF)                               (ADJ)        (MAF)

                 12609        10051       9959        9951        12076


     *****       BTU RE      BTU RE       BTU RE      BTU RE
                 -----PRODUCT-----        -----UPG COAL-----
                             (ADJ)                    (ADJ)
                 116.52      116.61       102.75      102.83



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                              W1-M-12


                  *        YIELD%    YIELD%
                         (PRODUCT)  (UPG COAL)

                           93.30      88.64


                 **        RES%      RES%
                          (DETN)   (CAL FROM S)

                           5.00       5.81

                ***     ASH%     ASH%     ASH%
                       (DETN)   (CAL)   (CAL-UC)

                        23.19   19.83    20.87


       ****       BTU       BTU       BTU       BTU       BTU
                 (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
                 (MAF)                         (ADJ)      (MAF)

                 12297      9445     10031      9610     12212


       *****     BTU RE     BTU RE      BTU RE     BTU RE
                 -----PRODUCT-----      -----UPG COAL-----
                            (ADJ)                  (ADJ)
                 104.13     108.68       94.49      98.63



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                        W2-M-13


            *        YIELD%     YIELD%
                   (PRODUCT)  (UPG COAL)

                     94.30       90.32


           **         RES%       RES%
                     (DETN)   (CAL FROM S)

                      4.22        5.64

          ***      ASH%     ASH%      ASH%
                  (DETN)   (CAL)    (CAL-UC)

                   25.43    20.57    21.48


 ****        BTU         BTU         BTU        BTU         BTU
            (DETN)      (DETN)      (CAL)      (CAL)       (COAL)
            (MAF)                              (ADJ)        (MAF)

            12472        9300        9751       9155        12076


 *****      BTU RE      BTU RE        BTU RE      BTU RE
            -----PRODUCT-----         -----UPG COAL-----
                         (ADJ)                     (ADJ)
            106.02      112.93        97.61       103.97



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA  CHECKING

                            W3-M-14


              *        YIELD%    YIELD%
                     (PRODUCT)  (UPG COAL)

                       97.90      87.72


             **        RES%      RES%
                       (DETN)   (CAL FROM S)

                       10.40      12.04

            ***     ASH%     ASH%     ASH%
                   (DETN)   (CAL)    (CAL-UC)

                    24.17    22.47    25.08


    ****          BTU        BTU        BTU        BTU        BTU
                  (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
                  (MAF)                            (ADJ)      (MAF)

                  12605      9558       9873       9657       11974


    *****         BTU RE      BTU RE        BTU RE      BTU RE
                  -----PRODUCT-----         -----UPG COAL-----
                              (ADJ)                      (ADJ)
                  117.86      120.50        95.46       97.59



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                     DATA  CHECKING

                          W1-M-15


              *        YIELD%     YIELD%
                     (PRODUCT)  (UPG COAL)

                       90.50       85.53


             **         RES%       RES%
                       (DETN)  (CAL FROM S)

                        5.49        5.10

            ***     ASH%     ASH%      ASH%
                  (DETN)   (CAL)    (CAL-UC)

                   21.47    20.44    21.63


     ****       BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)      (CAL)      (CAL)     (COAL)
              (MAF)                             (ADJ)      (MAF)

              12593        9889      10069       9939      12212


     *****    BTU RE      BTU RE       BTU RE     BTU RE
              ------PRODUCT-----       ------UPG COAL-----
                          (ADJ)                   (ADJ)
              105.75      107.13       95.49      96.74



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                         W1-M-16


              *        YIELD%     YIELD%
                     (PRODUCT)  (UPG COAL)

                        91.60      87.02


             **        RES%       RES%
                       (DETN)   (CAL FROM S)

                        5.00        5.46

            ***     ASH%     ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                   21.09    20.20    21.26


     ****       BTU        BTU        BTU        BTU        BTU
               (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
               (MAF)                            (ADJ)       (MAF)

               12669       9997      10031       9918      12212


     *****     BTU RE      BTU RE         BTU RE      BTU RE
               -----PRODUCT-----          -----UPG COAL-----
                           (ADJ)                      (ADJ)
               108.20      109.43         98.75       99.87



(UPG COAL)---THE COAL PORTION OF THE PRODUC
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W3-M-17

```
         *          YIELD%      YIELD%
                  (PRODUCT)   (UPG COAL)

                   102.80       87.38


        **           RES%        RES%
                    (DETN)   (CAL FROM S)

                    15.00        13.28

       ***      ASH%      ASH%       ASH%
               (DETN)    (CAL)     (CAL-UC)

               25.00     21.40      25.18


****          BTU          BTU          BTU          BTU          BTU
             (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
             (MAF)                                  (ADJ)         (MAF)

             13065         9799        10263         9793        11974


*****        BTU RE        BTU RE        BTU RE        BTU RE
             -----PRODUCT-----           -----UPG COAL-----
                           (ADJ)                       (ADJ)
             126.88        132.97        92.95         97.41



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA  CHECKING

                                     W3-M-18


                         *        YIELD%    YIELD%
                                (PRODUCT)  (UPG COAL)

                                 105.60       89.13


                        **        RES%      RES%
                                  (DETN)  (CAL FROM S)

                                  15.60       14.00

                       ***     ASH%    ASH%    ASH%
                             (DETN)  (CAL)   (CAL-UC)

                               22.93   20.83   24.68


            ****       BTU       BTU       BTU       BTU       BTU
                       (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
                       (MAF)                         (ADJ)      (MAF)

                       12900      9942     10314     10041     11974


            *****      BTU RE     BTU RE      BTU RE     BTU RE
                       -----PRODUCT-----      -----UPG COAL-----
                                  (ADJ)                  (ADJ)
                       132.24     135.84       95.99      98.60


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                         W1-M-19


              *          YIELD%    YIELD%
                       (PRODUCT)  (UPG COAL)

                         89.70       85.46


             **          RES%       RES%
                        (DETN)   (CAL FROM S)

                         4.73         5.81

            ***      ASH%     ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                    26.91    20.62    21.65


    ****       BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
              (MAF)                            (ADJ)       (MAF)

              12389       9055      10010       9217      12212


    *****      BTU RE     BTU RE       BTU RE      BTU RE
              -----PRODUCT-----        -----UPG COAL-----
                          (ADJ)                    (ADJ)
               95.97      104.23       87.21       94.72



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                              W1-M-20


              *        YIELD%     YIELD%
                     (PRODUCT)   (UPG COAL)

                        89.00       84.19


             **         RES%       RES%
                       (DETN)   (CAL FROM S)

                        5.40         6.70

            ***     ASH%     ASH%      ASH%
                   (DETN)   (CAL)    (CAL-UC)

                   18.61    20.79     21.97


    ****        BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
              (MAF)                            (ADJ)       (MAF)

               12728      10359      10062      10338      12212


    *****     BTU RE     BTU RE       BTU RE     BTU RE
              -----PRODUCT-----       -----UPG COAL-----
                         (ADJ)                  (ADJ)
              108.94     106.03        99.02      96.37


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA  CHECKING

                            W2-M-21


                  *         YIELD%     YIELD%
                          (PRODUCT)  (UPG COAL)

                            90.00       82.37


                 **         RES%       RES%
                           (DETN)   (CAL FROM S)

                            8.48        8.30

                ***     ASH%     ASH%      ASH%
                       (DETN)   (CAL)    (CAL-UC)

                        18.11   21.56     23.55


        ****         BTU         BTU         BTU         BTU         BTU
                    (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                    (MAF)                               (ADJ)        (MAF)

                    12868       10538       10094       10538       12076


        *****       BTU RE      BTU RE           BTU RE      BTU RE
                    -----PRODUCT-----            -----UPG COAL-----
                                (ADJ)                        (ADJ)
                    114.65      109.83            98.53       94.39



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                     DATA  CHECKING

                          W3-M-22


              *       YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      92.00       79.67


             **       RES%      RES%
                      (DETN)   (CAL FROM S)

                      13.40       11.86

            ***    ASH%     ASH%     ASH%
                  (DETN)   (CAL)   (CAL-UC)

                   24.78    23.91    27.61


    ****       BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
              (MAF)                            (ADJ)       (MAF)

              13107       9859      10128      10012      11974


    *****      BTU RE     BTU RE       BTU RE     BTU RE
              ------PRODUCT-----       -----UPG COAL-----
                          (ADJ)                   (ADJ)
              114.25      115.57       87.12      88.12



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                        DATA  CHECKING

                             W2-M-23


                 *         YIELD%    YIELD%
                         (PRODUCT)  (UPG COAL)

                           91.50       81.07


                **         RES%       RES%
                          (DETN)   (CAL FROM S)

                           11.40        9.18

               ***      ASH%     ASH%      ASH%
                       (DETN)   (CAL)    (CAL-UC)

                        15.94    21.20     23.93


        ****       BTU         BTU        BTU        BTU        BTU
                 (DETN)      (DETN)      (CAL)      (CAL)     (COAL)
                 (MAF)                              (ADJ)      (MAF)

                 13006       10933       10330      11020      12076


        *****    BTU RE      BTU RE       BTU RE      BTU RE
                 -----PRODUCT-----        -----UPG COAL-----
                             (ADJ)                    (ADJ)
                 120.93      113.36        98.90       92.71



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

W3-M-24

```
                  *         YIELD%     YIELD%
                          (PRODUCT)  (UPG COAL)

                            89.00        79.74


                 **         RES%        RES%
                           (DETN)   (CAL FROM S)

                            10.40         9.55

                ***     ASH%     ASH%      ASH%
                       (DETN)   (CAL)    (CAL-UC)

                        24.80   24.72     27.59

       ****        BTU         BTU          BTU          BTU          BTU
                  (DETN)      (DETN)       (CAL)        (CAL)        (COAL)
                  (MAF)                                 (ADJ)         (MAF)

                  13017        9789         9873         9862         11974


       *****      BTU RE       BTU RE        BTU RE       BTU RE
                  -----PRODUCT-----         -----UPG COAL-----
                               (ADJ)                       (ADJ)
                  109.74       109.86        89.37        89.46


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA CHECKING

                        W2-M-25


               *        YIELD%     YIELD%
                      (PRODUCT)  (UPG COAL)

                        99.30       82.02


              **         RES%      RES%
                        (DETN)  (CAL FROM S)

                         8.15       6.35

             ***     ASH%     ASH%      ASH%
                    (DETN)   (CAL)    (CAL-UC)

                    21.60    21.72     23.65


    ****       BTU       BTU       BTU       BTU       BTU
              (DETN)    (DETN)    (CAL)     (CAL)    (COAL)
              (MAF)                         (ADJ)     (MAF)

              12735      9984     10068     10084     12076


    *****     BTU RE    BTU RE          BTU RE    BTU RE
              -----PRODUCT-----         -----UPG COAL-----
                         (ADJ)                    (ADJ)
              107.78    107.61           92.41     92.26


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                          W1-M-26


                  *        YIELD%     YIELD%
                         (PRODUCT)  (UPG COAL)

                           90.80       85.11


                 **         RES%       RES%
                           (DETN)   (CAL FROM S)

                            6.27        5.10

                ***      ASH%      ASH%      ASH%
                        (DETN)    (CAL)    (CAL-UC)

                         22.80     20.37     21.74


          ****      BTU         BTU         BTU         BTU         BTU
                   (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                   (MAF)                               (ADJ)        (MAF)

                   12662        9775       10130        9822       12212


          *****     BTU RE      BTU RE        BTU RE       BTU RE
                   -----PRODUCT-----         -----UPG COAL-----
                                (ADJ)                     (ADJ)
                   104.98      108.17         93.12        96.05



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA  CHECKING

                            W3-M-27


                   *          YIELD%     YIELD%
                            (PRODUCT)  (UPG COAL)

                              94.30       81.57


                  **          RES%       RES%
                              (DETN)   (CAL FROM S)

                              13.50       10.80

                 ***      ASH%     ASH%     ASH%
                         (DETN)   (CAL)   (CAL-UC)

                         24.26    23.33    26.97


        ****        BTU         BTU         BTU         BTU         BTU
                   (DETN)      (DETN)      (CAL)       (CAL)      (COAL)
                   (MAF)                               (ADJ)       (MAF)

                   12901        9771       10136       10013       11974


        *****       BTU RE      BTU RE        BTU RE      BTU RE
                   -----PRODUCT-----         -----UPG COAL-----
                                 (ADJ)                    (ADJ)
                   116.06       117.49        88.04       89.12


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                         W1-E-1


              *          YIELD%      YIELD%
                        (PRODUCT)   (UPG COAL)

                          91.90       85.65


             **          RES%        RES%
                        (DETN)     (CAL FROM S)

                          6.80         8.10

            ***      ASH%      ASH%      ASH%
                    (DETN)    (CAL)    (CAL-UC)

                     22.02     20.13     21.60


     ****        BTU          BTU          BTU          BTU          BTU
                (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                (MAF)                                  (ADJ)        (MAF)

                12442         9702        10197         9956        12212


     *****       BTU RE       BTU RE           BTU RE        BTU RE
                 -----PRODUCT-----             -----UPG COAL-----
                              (ADJ)                          (ADJ)
                 105.35       107.91            92.18         94.41




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


  91.90      6.80

  22.02      0.48      9702
```

```
                         DATA CHECKING

                            W2-E-2


               *         YIELD%      YIELD%
                       (PRODUCT)   (UPG COAL)

                          93.20       86.12


              **          RES%        RES%
                         (DETN)   (CAL FROM S)

                          7.60        8.12

             ***       ASH%     ASH%      ASH%
                      (DETN)   (CAL)    (CAL-UC)

                      26.66    20.82     22.53


        ****       BTU         BTU        BTU        BTU        BTU
                  (DETN)      (DETN)     (CAL)      (CAL)      (COAL)
                  (MAF)                             (ADJ)      (MAF)

                  12224        8965      10051       9310      12076


        *****      BTU RE      BTU RE        BTU RE      BTU RE
                   -----PRODUCT-----         -----UPG COAL-----
                               (ADJ)                     (ADJ)
                   101.01      109.06        85.73       92.56




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


  93.20      7.60

  26.66      0.48      8965
```

```
                         DATA  CHECKING

                              W3-E-3


                    *        YIELD%     YIELD%
                           (PRODUCT)  (UPG COAL)

                            100.20       94.85


                   **        RES%       RES%
                            (DETN)  (CAL FROM S)

                            15.32       15.26

                  ***     ASH%     ASH%     ASH%
                        (DETN)   (CAL)   (CAL-UC)

                         24.42    21.96    25.93


         ****       BTU         BTU        BTU        BTU        BTU
                   (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                   (MAF)                            (ADJ)       (MAF)

                   12945        9784     10347      10020      11974


         *****     BTU RE     BTU RE       BTU RE      BTU RE
                   -----PRODUCT-----       -----UPG COAL-----
                                (ADJ)                  (ADJ)
                   123.49     127.51        88.99       91.99



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


100.20    15.32

 24.42     0.62     9784
```

DATA CHECKING

```
                          W1-E-4

             *        YIELD%     YIELD%
                    (PRODUCT)  (UPG COAL)

                      92.30       85.76

            **        RES%        RES%
                     (DETN)   (CAL FROM S)

                      7.09        10.44

           ***     ASH%     ASH%      ASH%
                  (DETN)   (CAL)    (CAL-UC)

                  17.33    20.04     21.57

  ****       BTU        BTU        BTU        BTU        BTU
            (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
            (MAF)                            (ADJ)      (MAF)

            12572      10393      10221      10567      12212


  *****     BTU RE      BTU RE        BTU RE     BTU RE
            -----PRODUCT-----         -----UPG COAL-----
                        (ADJ)                    (ADJ)
            113.35      109.63         99.55      96.29



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 92.30     7.09

 17.33     0.52    10393
```

DATA CHECKING

W2-E-5

```
     *          YIELD%     YIELD%
              (PRODUCT)  (UPG COAL)

                 91.60      83.63


     **          RES%       RES%
                (DETN)   (CAL FROM S)

                 8.70        6.36

    ***      ASH%     ASH%     ASH%
            (DETN)   (CAL)   (CAL-UC)

            24.12    21.18    23.20

****      BTU        BTU        BTU        BTU        BTU
         (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
         (MAF)                            (ADJ)      (MAF)

         12319      9348       10144      9766       12076


*****    BTU RE     BTU RE        BTU RE     BTU RE
         -----PRODUCT-----        -----UPG COAL-----
                    (ADJ)                    (ADJ)
         103.52     107.53        96.33      99.67



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 91.60     8.70

 24.12     0.45     9348
```

DATA CHECKING

```
                               W1-E-6


              *         YIELD%    YIELD% ..
                      (PRODUCT)  (UPG COAL)

                         94.10       85.01


             **          RES%       RES%
                        (DETN)  (CAL FROM S)

                          9.66        6.34

            ***      ASH%     ASH%     ASH%
                    (DETN)   (CAL)   (CAL-UC)

                    18.56   19.66    21.76


   ****      BTU        BTU        BTU        BTU        BTU
            (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
            (MAF)                            (ADJ)      (MAF)

            12563      10231      10431      10574      12212



   *****    BTU RE     BTU RE       BTU RE     BTU RE
            -----PRODUCT-----       -----UPG COAL-----
                       (ADJ)                   (ADJ
            113.76     112.22        94.59      93.22




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY



94.10     9.66

18.56     0.45   10231
```

DATA CHECKING

W2-E-7

```
          *         YIELD%     YIELD%
                  (PRODUCT)  (UPG COAL)

                    94.30       84.50


         **         RES%       RES%
                   (DETN)   (CAL FROM S)

                    10.39       4.02

        ***     ASH%     ASH%      ASH%
               (DETN)   (CAL)    (CAL-UC)

                16.19    20.57     22.96


****         BTU          BTU          BTU          BTU          BTU
            (DETN)       (DETN)       (CAL)        (CAL)       (COAL)
            (MAF)                                  (ADJ)        (MAF)

            12552        10520        10287        10854        12076


*****        BTU RE       BTU RE         BTU RE       BTU RE
             -----PRODUCT-----           -----UPG COAL-----
                          (ADJ)                       (ADJ)
             119.93       117.66          98.79        93.63



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.30    10.39

 16.19     0.41    10520
```

DATA CHECKING

W3-E-8

```
                              *         YIELD%      YIELD%
                                      (PRODUCT)     (UPG COAL)

                                        99.70          84.13

                            **          RES%          RES%
                                         (DETN)   (CAL FROM S)

                                         15.62         14.08

                           ***       ASH%     ASH%      ASH%
                                   (DETN)    (CAL)    (CAL-UC)

                                     28.62    22.07     26.15

              ****          BTU         BTU          BTU         BTU         BTU
                           (DETN)      (DETN)      (CAL)        (CAL)      (COAL)
                           (MAF)                                (ADJ)        (MAF)

                           12728         9085       10373         9501       11974


              *****        BTU RE       BTU RE         BTU RE       BTU RE
                           -----PRODUCT-----          -----UPG COAL-----
                                         (ADJ)                       (ADJ)
                           114.09       124.57          79.09        86.35



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 99.70      15.62

 28.62       0.60      9085
```

DATA CHECKING

```
                         W3-E-9


             *          YIELD%     YIELD%
                       (PRODUCT)  (UPG COAL)

                         97.90       82.05


            **           RES%        RES%
                        (DETN)   (CAL FROM S)

                         16.19       14.08

           ***      ASH%      ASH%      ASH%
                   (DETN)    (CAL)    (CAL-UC)

                    23.71     22.47     26.81


  ****          BTU         BTU        BTU        BTU        BTU
               (DETN)      (DETN)     (CAL)      (CAL)      (COAL)
               (MAF)                             (ADJ)       (MAF)

               12868        9817      10424      10257      11974



  *****        BTU RE      BTU RE         BTU RE      BTU RE
               -----PRODUCT-----          -----UPG COAL-----
                           (ADJ)                      (ADJ)
               121.06      123.02          85.44       86.82




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 97.90    16.19

 23.71     0.60    9817
```

DATA CHECKING

```
                                    W1-E-10


                        *        YIELD%    YIELD%
                               (PRODUCT)  (UPG COAL)

                                 94.20       86.22

                       **        RES%      RES%
                                 (DETN)  (CAL FROM S)

                                  8.47        6.34

                      ***     ASH%    ASH%    ASH%
                            (DETN)  (CAL)   (CAL-UC)

                              20.49   19.64   21.46

           ****        BTU       BTU       BTU       BTU       BTU
                      (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
                      (MAF)                         (ADJ)       (MAF)

                      12458      9905     10334     10224     12212

           *****      BTU RE     BTU RE      BTU RE     BTU RE
                      -----PRODUCT-----      -----UPG COAL-----
                                 (ADJ)                   (ADJ)
                      110.25     111.43       93.43      94.43


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.20     8.47

 20.49     0.45    9905
```

DATA CHECKING

```
                         W2-E-11

              *        YIELD%     YIELD%
                     (PRODUCT)  (UPG COAL)

                        95.50      83.75

             **         RES%       RES%
                       (DETN)   (CAL FROM S)

                        12.30       6.95

            ***      ASH%     ASH%     ASH%
                    (DETN)   (CAL)   (CAL-UC)

                     19.45    20.31    23.16

     ****        BTU         BTU         BTU         BTU         BTU
                (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                (MAF)                               (ADJ)        (MAF)

                 12536       10098       10448       10561       12076


     *****       BTU RE      BTU RE        BTU RE     BTU RE
                 -----PRODUCT-----         -----UPG COAL-----
                               (ADJ)                    (ADJ)
                 116.58      115.33         91.24      90.27



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


  95.50     12.30

  19.45      0.46    10098
```

DATA CHECKING

```
                              W3-E-12

                  *         YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                           106.20      87.08

                 **         RES%      RES%
                           (DETN)   (CAL FROM S)

                            18.00      17.63

                ***      ASH%     ASH%      ASH%
                        (DETN)   (CAL)    (CAL-UC)

                        25.88    20.72     25.26

        ****       BTU        BTU        BTU        BTU        BTU
                  (DETN)    (DETN)      (CAL)      (CAL)     (COAL)
                  (MAF)                            (ADJ)      (MAF)

                  13299      9857       10584       9895      11974


        *****      BTU RE      BTU RE        BTU RE      BTU RE
                   -----PRODUCT-----         -----UPG COAL-----
                               (ADJ)                     (ADJ)
                   131.86     141.04         88.90       95.09


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


106.20    18.00

 25.88     0.66     9857
```

```
                         DATA CHECKING

                            W1-E-13


                *        YIELD%      YIELD%
                       (PRODUCT)   (UPG COAL)

                         93.20       83.83


               **        RES%        RES%
                        (DETN)   (CAL FROM S)

                         10.05        6.34

              ***     ASH%     ASH%      ASH%
                    (DETN)   (CAL)    (CAL-UC)

                     33.02    19.85     22.07


     ****       BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
              (MAF)                            (ADJ)       (MAF)

              12010       8044      10463       8744       12212


     *****    BTU RE     BTU RE       BTU RE    BTU RE
              -----PRODUCT-----       -----UPG COAL-----
                          (ADJ)                  (ADJ)
               98.59     106.00       68.84     82.37



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.20    10.05

 33.02     0.45    8044
```

DATA CHECKING

```
                              W2-E-14

                   *       YIELD%     YIELD%
                          (PRODUCT)  (UPG COAL)

                            94.70       83.72

                  **        RES%       RES%
                           (DETN)   (CAL FROM S)

                            11.59        6.36

                 ***     ASH%     ASH%      ASH%
                        (DETN)   (CAL)    (CAL-UC)

                         22.97   20.49     23.17

        ****       BTU        BTU        BTU        BTU        BTU
                  (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                  (MAF)                            (ADJ)       (MAF)

                  12233       9423      10388      10063      12076


        *****     BTU RE     BTU RE      BTU RE     BTU RE
                  -----PRODUCT-----      -----UPG COAL-----
                              (ADJ)                 (ADJ)
                  107.88     111.36       84.20      86.92



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.70    11.59

 22.97     0.45    9423
```

DATA CHECKING

```
                              W1-E-15


                 *          YIELD%     YIELD%
                          (PRODUCT)  (UPG COAL)

                             93.60      82.17


                **           RES%       RES%
                            (DETN)   (CAL FROM S)

                             12.21        7.51

               ***       ASH%      ASH%      ASH%
                        (DETN)    (CAL)    (CAL-UC)

                        17.22     19.76     22.51


        ****        BTU         BTU         BTU         BTU         BTU
                   (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                   (MAF)                               (ADJ)        (MAF)

                   12577       10411       10641       10978       12212


        *****      BTU RE      BTU RE         BTU RE     BTU RE
                   -----PRODUCT-----          -----UPG COAL-----
                                (ADJ)                    (ADJ)
                   115.14      111.60          91.05      88.25



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.60     12.21

 17.22      0.47    10411
```

DATA CHECKING

W2-E-16

```
              *        YIELD%     YIELD% ..
                     (PRODUCT)  (UPG COAL)

                        95.30       84.14

             **         RES%       RES%
                       (DETN)   (CAL FROM S)

                        11.71        6.36

            ***      ASH%     ASH%     ASH%
                    (DETN)   (CAL)    (CAL-UC)

                     17.95    20.36    23.06

       ****       BTU         BTU         BTU         BTU         BTU
                 (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                 (MAF)                               (ADJ)        (MAF)

                 12392       10168       10399       10712       12076


       *****      BTU RE       BTU RE        BTU RE       BTU RE
                  -----PRODUCT-----          -----UPG COAL-----
                               (ADJ)                      (ADJ)
                  117.14       113.71         93.07        90.34



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.30     11.71

 17.95      0.45    10168
```

DATA CHECKING

```
                            W1-E-17


             *        YIELD%     YIELD%
                    (PRODUCT)  (UPG COAL)

                       91.60      84.02


            **         RES%       RES%
                      (DETN)  (CAL FROM S)

                        8.27       3.41

           ***    ASH%     ASH%      ASH%
                 (DETN)   (CAL)    (CAL-UC)

                  28.15    20.20     22.02


  ****       BTU       BTU       BTU       BTU       BTU
            (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
            (MAF)                         (ADJ)      (MAF)

            12412      8918     10317      9289     12212


  *****     BTU RE     BTU RE      BTU RE     BTU RE
            ------PRODUCT-----     ------UPG COAL-----
                       (ADJ)                  (ADJ)
             96.52     107.21       90.55      89.47




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 91.60     8.27

 28.15     0.40     8918
```

DATA CHECKING

```
                          W2-E-18

            *       YIELD%     YIELD%
                   (PRODUCT)  (UPG COAL)

                     94.00      83.47

           **        RES%       RES%
                    (DETN)   (CAL FROM S)

                     11.20       9.29

          ***     ASH%     ASH%     ASH%
                 (DETN)   (CAL)   (CAL-UC)

                  19.26    20.64    23.24

   ****       BTU        BTU        BTU        BTU        BTU
             (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
             (MAF)                            (ADJ)      (MAF)

             12587      10163      10355      10535      12076

   *****      BTU RE     BTU RE       BTU RE     BTU RE
              -----PRODUCT-----       -----UPG COAL-----
                         (ADJ)                   (ADJ)
              115.49     113.52       92.78      91.20


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.00    11.20

 19.26     0.50   10163
```

DATA CHECKING

W1-E-19

```
                         *          YIELD%      YIELD%
                                  (PRODUCT)  (UPG COAL)

                                    91.10       83.98


                        **          RES%        RES%
                                   (DETN)   (CAL FROM S)

                                    7.93        6.34

                       ***      ASH%     ASH%     ASH%
                               (DETN)   (CAL)   (CAL-UC)

                                19.47    20.31    22.06


             ****      BTU        BTU        BTU        BTU        BTU
                      (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                      (MAF)                            (ADJ)      (MAF)

                      12609      10154      10289      10398      12212


             *****    BTU RE     BTU RE        BTU RE     BTU RE
                      -----PRODUCT-----        -----UPG COAL-----
                                  (ADJ)                    (ADJ)
                      109.30     108.17         94.07      93.09



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 91.10     7.93

 19.47     0.45    10154
```

```
                      DATA  CHECKING

                            W2-E-20


              *        YIELD%    YIELD%
                     (PRODUCT)  (UPG COAL)

                       92.10      82.97


             **        RES%       RES%
                       (DETN)   (CAL FROM S)

                        9.91        9.87

            ***     ASH%     ASH%     ASH%
                   (DETN)   (CAL)    (CAL-UC)

                    20.09    21.06    23.38

    ****      BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
              (MAF)                            (ADJ)      (MAF)

              12280       9813      10246      10373      12076


    *****     BTU RE     BTU RE        BTU RE     BTU RE
              -----PRODUCT-----        -----UPG COAL-----
                         (ADJ)                    (ADJ)
              109.26     107.93        89.57      88.49



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 92.10     9.91

 20.09     0.51     9813
```

```
                              DATA  CHECKING

                                  W1-E-21


                        *        YIELD%     YIELD%
                              (PRODUCT)   (UPG COAL)

                                 91.80        82.88


                        **        RES%        RES%
                                 (DETN)   (CAL FROM S)

                                  9.72         8.10

                       ***     ASH%      ASH%      ASH%
                              (DETN)    (CAL)     (CAL-UC)

                               25.02     20.15     22.32


              ****        BTU          BTU          BTU          BTU          BTU
                          (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                          (MAF)                                  (ADJ)        (MAF)

                          12575        9429         10436        9800         12212


              *****       BTU RE       BTU RE           BTU RE       BTU RE
                          -----PRODUCT-----             -----UPG COAL-----
                                       (ADJ)                         (ADJ)
                          102.28       108.92            83.47        89.99



      (UPG COAL)---THE COAL PORTION OF THE PRODUCT
      (DETN)---FROM ACTUAL DETERMINATION
      (CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
      (CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
      (MAF)---MOISTURE ASH FREE BASIS
      (ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
      BTU RE---BTU RECOVERY


       91.80      9.72

       25.02      0.48      9429
```

```
                         DATA  CHECKING

                            W2-E-22


                     *         YIELD%    YIELD%
                             (PRODUCT)  (UPG COAL)

                                92.30       82.13


                    **          RES%       RES%
                               (DETN)   (CAL FROM S)

                               11.02        11.04

                   ***     ASH%     ASH%      ASH%
                          (DETN)   (CAL)    (CAL-UC)

                           24.73    21.02    23.62


      ****          BTU         BTU         BTU         BTU         BTU
                   (DETN)      (DETN)      (CAL)       (CAL)      (COAL)
                   (MAF)                               (ADJ)       (MAF)

                   12495        9405       10340        9854       12076


      *****         BTU RE      BTU RE       BTU RE      BTU RE
                    -----PRODUCT-----        -----UPG COAL-----
                                (ADJ)                    (ADJ)
                   104.94      110.12        93.00        87.10



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 92.30    11.02

 24.73     0.53    9405
```

```
                         DATA  CHECKING

                             W1-E-1A

                    *        YIELD%     YIELD%
                           (PRODUCT)  (UPG COAL)

                              90.90       82.05


                   **         RES%       RES%
                             (DETN)   (CAL FROM S)

                               9.74        5.76

                  ***     ASH%     ASH%      ASH%
                        (DETN)   (CAL)    (CAL-UC)

                         23.77    20.35     22.55


      ****         BTU        BTU        BTU        BTU        BTU
                  (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
                  (MAF)                            (ADJ)      (MAF)

                  12289       9368      10438       9990      12212


      *****        BTU RE      BTU RE         BTU RE      BTU RE
                   -----PRODUCT-----          -----UPG COAL-----
                                (ADJ)                      (ADJ)
                   100.62      105.13          91.95       95.63



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 90.90     9.74

 23.77     0.44     9368
```

DATA CHECKING

P2-D-1B

```
*         YIELD%     YIELD%
        (PRODUCT)  (UPG COAL)

          88.20       76.73


**        RES%       RES%
         (DETN)   (CAL FROM S)

          13.00       14.93


***     ASH%     ASH%      ASH%
       (DETN)   (CAL)    (CAL-UC)

       20.62    19.61    22.55


****          BTU          BTU          BTU          BTU          BTU
             (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
             (MAF)                                  (ADJ)        (MAF)

             12523         9941         9848         9724        11122


*****         BTU RE       BTU RE         BTU RE       BTU RE
             -----PRODUCT-----            -----UPG COAL-----
                          (ADJ)                       (ADJ)
             124.74       126.32         96.49        97.72


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                         P3-D-2

          *         YIELD%     YIELD%
                  (PRODUCT)  (UPG COAL)

                    99.70        79.52


         **         RES%        RES%
                   (DETN)   (CAL FROM S)

                    20.24        27.47

        ***     ASH%     ASH%     ASH%
               (DETN)   (CAL)    (CAL-UC)

                19.49    20.36    25.53


****        BTU        BTU        BTU        BTU        BTU
           (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
           (MAF)                            (ADJ)      (MAF)

           12979      10449      10060      10170      10910


*****       BTU RE     BTU RE        BTU RE     BTU RE
            ------PRODUCT-----       -----UPG COAL-----
                       (ADJ)                    (ADJ)
            154.02     152.35        102.36     101.35



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

P3-D-3B

```
          *        YIELD%     YIELD%
                 (PRODUCT)  (UPG COAL)

                   91.30       72.25


         **        RES%        RES%
                  (DETN)   (CAL FROM S)

                   20.87       20.38


        ***     ASH%     ASH%      ASH%
               (DETN)   (CAL)    (CAL-UC)

                22.48   22.23     28.10


****        BTU        BTU        BTU        BTU        BTU
           (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
           (MAF)                            (ADJ)      (MAF)

           12753       9886      10117      10085      10910


*****      BTU RE      BTU RE        BTU RE      BTU RE
           -----PRODUCT-----         -----UPG COAL-----
                       (ADJ)                     (ADJ)
           133.44      133.86         84.66       84.93



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                          P1-D-4E


            *        YIELD%     YIELD%
                    (PRODUCT)  (UPG COAL

                     34.70        72.97


           **        RES%        RES%
                    (DETN)   (CAL FROM S)

                     13.85        13.74

          ***      ASH%     ASH%     ASH%
                  (DETN)   (CAL)    (CAL-UC)

                  17.12    13.42    21.38

   ****        BTU         BTU         BTU         BTU         BTU
              (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
              (MAF)                               (ADJ)       (MAF)

              13744       10371       10129       10289       11193


   *****       BTU RE      BTU RE       BTU RE     BTU RE
               -----PRODUCT-----        -----UPG COAL-----
                           (ADJ)                   (ADJ)
               123.41      120.50       97.72      92.25



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                               P3-D-5E


                 *          YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL

                            93.30       75.59


                **           RES%      RES%
                            (DETN)  (CAL FROM S)

                            19.15       20.01

               ***       ASH%     ASH%     ASH%
                        (DETN)   (CAL)   (CAL-UC)

                         23.03    21.71    26.35


     ****          BTU         BTU         BTU        BTU        BTU
                  (DETN)      (DETN)      (CAL)      (CAL)     (COAL)
                  (MAF)                              (ADJ)      (MAF)

                  10843        9579        9961       9787      10910


     *****        BTU RE      BTU RE       BTU RE      BTU RE
                  -----PRODUCT-----        -----UPG COAL-----
                               (ADJ)                   (ADJ)
                  176.56      178.99       90.70       92.74



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)----MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA CHECKING

                        P1-D-6C


              *          YIELD%     YIELD%
                       (PRODUCT)  (UPG COAL)

                         85.00        72.81


             **          RES%        RES%
                        (DETN)   (CAL FROM S)

                         14.34        15.36


            ***      ASH%      ASH%      ASH%
                    (DETN)    (CAL)    (CAL-UC)

                     14.84     18.35     21.43


     ****          BTU       BTU       BTU       BTU       BTU
                  (DETN)    (DETN)    (CAL)     (CAL)    (COAL)
                  (MAF)                         (ADJ)     (MAF)

                  12530     10688     10169     10606     11183


     *****         BTU RE     BTU RE       BTU RE     BTU RE
                   -----PRODUCT-----       -----UPG COAL-----
                               (ADJ)                    (ADJ)
                   128.33     123.04        98.52      94.45



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                          P1-D-7


               *          YIELD%     YIELD%
                        (PRODUCT)  (UPG COAL)

                          83.10       70.80


              **          RES%       RES%
                          (DETN)   (CAL FROM S)

                          14.80       40.57

             ***       ASH%      ASH%       ASH%
                      (DETN)    (CAL)     (CAL-UC)

                       19.65     18.77      22.03


     ****      BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
              (MAF)                            (ADJ)       (MAF)

              12825      10305      10207      10097      11183


     *****     BTU RE     BTU RE       BTU RE     BTU RE
              -----PRODUCT-----       -----UPG COAL-----
                          (ADJ)                  (ADJ)
              120.97     122.29        90.89      91.98




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIE
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA  CHECKING

                               P2-D-8


                  *       YIELD%    YIELD%
                        (PRODUCT)  (UPG COAL)

                          92.50       69.98


                 **       RES%      RES%
                         (DETN)   (CAL FROM S)

                          15.17       14.75

                ***     ASH%     ASH%     ASH%
                       (DETN)   (CAL)   (CAL-UC)

                        22.41    20.97    24.72


       ****       BTU         BTU        BTU        BTU        BTU
                 (DETN)      (DETN)     (CAL)      (CAL)      (COAL)
                 (MAF)                             (ADJ)       (MAF)

                 12746        9890      10034       9851       11122


       *****      BTU RE      BTU RE        BTU RE     BTU RE
                 -----PRODUCT-----          -----UPG COAL-----
                              (ADJ)                   (ADJ)
                 116.08      118.23         85.25      86.83



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

P2-D-9

```
*          YIELD%      YIELD%
         (PRODUCT)   (UPG COAL)

            87.70       75.63


**          RES%        RES%
           (DETN)    (CAL FROM S)

            13.76       11.07

***      ASH%      ASH%      ASH%
        (DETN)    (CAL)    (CAL--UC)

         22.86     19.73     22.87


****       BTU         BTU         BTU         BTU         BTU
         (DETN)      (DETN)       (CAL)       (CAL)      (COAL)
         (MAF)                                (ADJ)       (MAF)

         12656        9763        9913        9526       11122


*****    BTU RE      BTU RE        BTU RE      BTU RE
         -----PRODUCT-----         -----UPG COAL-----
                      (ADJ)                     (ADJ)
         121.91      126.76        92.08       95.82



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                 DATA  CHECKING

                      P1-D-10


            *        YIELD%     YIELD%
                   (PRODUCT)  (UPG COAL)

                     39.50       73.46


           **         RES%       RES%
                     (DETN)   (CAL FROM S)

                     17.90       16.44

          ***     ASH%     ASH%      ASH%
                 (DETN)   (CAL)    (CAL-UC)

                  15.30    17.43    21.24


  ****        BTU        BTU        BTU        BTU        BTU
             (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
             (MAF                             (ADJ)      (MAF

              11207      10748      10467      10750      11183



  *****       BTU RE      BTU RE        BTU RE      BTU RE
              -----PRODUCT-----         -----UPG COAL-----
                          (ADJ                      ADJ
              100.83      107.79        [illegible]   85.1[illegible]



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORETICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

```
                              P2-D-11B


                 *        YIELD%     YIELD%
                        (PRODUCT)   (UPG COAL)

                           83.90       59.37


                **         RES%        RES%
                          DETN)   (CAL FROM S)

                           17.36       14.56

               ***      ASH%     ASH%      ASH%
                      (DETN)   (CAL)    (CAL-UC)

                        22.84   20.62    24.95


      ****         BTU          BTU          BTU          BTU          BTU
                  (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                  (MAF                                   (ADJ)        (MAF)

                  12444         9602        10222         9976        11122


      *****        BTU RE       BTU RE        BTU RE     BTU RE
                  -----PRODUCT-----          -----UPG COAL-----
                                (ADJ                      (ADJ
                  113.61       117.91         78.77       81.00



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                        P3-D-12


         *          YIELD%     YIELD%
                  (PRODUCT)  (UPG COAL)

                    104.90      34.12


        **           RES%       RES%
                    (DETN)  (CAL FROM S)

                     19.73      27.65

       ***       ASH%     ASH%     ASH%
                (DETN)   (CAL)   (CAL-UC

                 19.40    19.37    24.13

 ****         BTU        BTU        BTU        BTU        BTU
             (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
             (MAF                             (ADJ)      (MAF)

              11097      10556      10014      10010      10910


 *****        BTU RE     BTU RE        BTU RE     BTU RE
              -----PRODUCT-----        -----UPG COAL-----
                         (ADJ                     (ADJ)
              163.55     163.51        110.82     110.86


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA CHECKING

                            P2-D-14


                   *       YIELD%    YIELD%
                         (PRODUCT)  (UPG COAL)

                           88.30       72.85


                  **       RES%       RES%
                          (DETN)   (CAL FROM S)

                           17.50       20.07

                 ***     ASH%    ASH%     ASH%
                       (DETN)   (CAL)   (CAL-UC)

                         17.44   19.59   23.75


         ****       BTU       BTU       BTU       BTU       BTU
                  (DETN)    (DETN)     (CAL)     (CAL)    (COAL)
                  (MAF)                          (ADJ)     (MAF)

                  12478     10302     10234     10508     11122


         *****    BTU RE     BTU RE       BTU RE     BTU RE
                  -----PRODUCT-----       -----UPG COAL-----
                              (ADJ)                   (ADJ)
                  129.42     126.04        91.35      88.97


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                         P2-D-15


            *         YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      90.10       73.63


           **         RES%      RES%
                     (DETN)   (CAL FROM S)

                      18.28       20.44

          ***      ASH%     ASH%     ASH%
                  (DETN)   (CAL)   (CAL-UC)

                  20.44    19.20    23.50


  ****       BTU         BTU         BTU        BTU        BTU
            (DETN)      (DETN)      (CAL)      (CAL)      (COAL)
            (MAF)                              (ADJ)      (MAF)

            12665       10076       10301      10143      11122


  *****      BTU RE      BTU RE        BTU RE      BTU RE
            -----PRODUCT-----         -----UPG COAL-----
                         (ADJ)                     (ADJ)
            129.16      131.17         88.58       89.96



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

P1-D-16

```
*          YIELD%     YIELD%
         (PRODUCT)  (UPG COAL)

           35.00       71.47


**          RES%       RES%
           (DETN)   (CAL FROM S)

           15.97       17.88

***      ASH%     ASH%     ASH%
        (DETN)   (CAL)    (CAL-UC)

         21.54   19.35    21.84


****      BTU        BTU        BTU        BTU        BTU
          (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
          (MAF)                            (ADJ)      (MAF

          12404       9772      10305      9902       11137


*****     BTU RE     BTU RE      BTU RE     BTU RE
          -----PRODUCT-----      -----UPG COAL-----
                     (ADJ)                  (ADJ)
          116.86     121.60      87.65      87.05



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                         DATA CHECKING

                            P1-D-17


                 *          YIELD%     YIELD%
                         (PRODUCT)   (UPG COAL)

                            34.70       72.53


                **           RES%        RES%
                            (DETN)   (CAL FROM S)

                            14.39       16.08

               ***      ASH%      ASH%      ASH%
                       (DETN)    (CAL)    (CAL-UC)

                        20.85     18.42     21.51


       ****        BTU         BTU         BTU         BTU         BTU
                  (DETN)      (DETN)      (CAL)       (CAL)      (COAL)
                  (MAF                                (ADJ)       (MAF)

                  12434        9957       10172        9869       11193


       *****       BTU RE      BTU RE         BTU RE      BTU RE
                  -----PRODUCT-----           -----UPG COAL-----
                               ADJ                        (ADJ
                  117.94      101.56          88.15       90.85



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                              DATA CHECKING

                                 PJ-D-18


                *        YIELD%     YIELD%
                       (PRODUCT)  (UPG COAL)

                          96.90       75.50


                **         RES%        RES%
                          (DETN)  (CAL FROM S)

                          22.08       19.50

               ***     ASH%     ASH%      ASH%
                      (DETN)   (CAL)    (CAL-UC)

                      22.38    20.95     26.89


        ****       BTU        BTU        BTU        BTU        BTU
                  (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                  (MAF)                            (ADJ)      (MAF)

                  12997      10011      10227      10042      10910


        *****      BTU RE      BTU RE        BTU RE     BTU RE
                   -----PRODUCT-----         -----UPG COAL-----
                                (ADJ)                   (ADJ)
                   143.42      146.06        88.64      90.28




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)----MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                        DATA   CHECKING

                            P1-D-19


                  *          YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                             92.20       75.71


                 **          RES%      RES%
                            (DETN)  (CAL FROM S)

                             17.89       17.88

                ***      ASH%     ASH%     ASH%
                        (DETN)   (CAL)   (CAL-UC)

                         15.24    16.92    20.61


       ****      BTU        BTU        BTU        BTU        BTU
                (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                (MAF)                            (ADJ)       (MAF)

                12725      10786      10465      10676      11183


      *****     BTU RE     BTU RE       BTU RE     BTU RE
                -----PRODUCT-----       -----UPG COAL-----
                           (ADJ)                   (ADJ)
                140.48     137.70       100.13      98.15



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                         P1-D-20


              *        YIELD%      YIELD%
                     (PRODUCT)   (UPG COAL)

                       88.40        75.27


             **         RES%        RES%
                       (DETN)   (CAL FROM S)

                       14.85        14.82

            ***      ASH%      ASH%      ASH%
                    (DETN)    (CAL)    (CAL-UC)

                     17.31     17.65     20.72


    ****          BTU         BTU         BTU         BTU         BTU
                 (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                 (MAF)                               (ADJ)        (MAF)

                 12708       10508       10211       10253       11183


    *****         BTU RE      BTU RE       BTU RE      BTU RE
                  -----PRODUCT-----        -----UPG COAL-----
                               (ADJ)                   (ADJ)
                  131.22      130.69        99.11       98.71



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

P2-D-21

```
          *         YIELD%     YIELD%
                  (PRODUCT)  (UPG COAL)

                    89.60       76.21


         **         RES%       RES%
                   (DETN)   (CAL FROM S)

                    14.94       17.50

        ***     ASH%      ASH%      ASH%
               (DETN)    (CAL)    (CAL-UC)

                19.21     19.31     22.70

****          BTU         BTU         BTU         BTU         BTU
             (DETN)      (DETN)      (CAL)       (CAL)      (COAL)
             (MAF)                               (ADJ)       (MAF)

             12513       10109       10014       10026       11122


*****        BTU RE      BTU RE        BTU RE      BTU RE
             -----PRODUCT-----         -----UPG COAL-----
                         (ADJ)                     (ADJ)
             128.86      128.70         95.88       95.77
```

(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY

```
                     DATA  CHECKING

                          P2-D-22G


              *         YIELD%     YIELD%
                       (PRODUCT)  (UPG COAL)

                         91.00       73.46


             **         RES%       RES%
                        (DETN)   (CAL FROM S)

                         19.27       22.46

            ***     ASH%     ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                    21.65    19.01    23.55


   ****      BTU        BTU        BTU        BTU        BTU
             (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
             (MAF)                            (ADJ)      (MAF)

             12905      10111      10386      10047      11122


   *****     BTU RE     BTU RE       BTU RE     BTU RE
             -----PRODUCT-----       -----UPG COAL-----
                        (ADJ)                   (ADJ)
             130.90     135.31        87.70      90.66



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                 DATA  CHECKING

                      P3-D-23


                  *       YIELD%    YIELD%
                        (PRODUCT)  (UPG COAL)

                          94.20       77.54


                 **       RES%      RES%
                          (DETN)  (CAL FROM S)

                          17.69       20.94

                ***     ASH%     ASH%     ASH%
                       (DETN)   (CAL)   (CAL-UC)

                        22.10    21.55    26.18


      ****      BTU      BTU      BTU      BTU      BTU
               (DETN)   (DETN)   (CAL)    (CAL)    (COAL)
               (MAF)                      (ADJ)    (MAF)

               12662     9864     9828     9759    10910


      *****    BTU RE      BTU RE      BTU RE     BTU RE
               -----PRODUCT-----      -----UPG COAL-----
                           (ADJ)                  (ADJ)
               137.37      138.34      94.71      95.38


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA  CHECKING

                        P3-D-24


             *        YIELD%     YIELD%
                    (PRODUCT)  (UPG COAL)

                      95.70       77.25


            **        RES%       RES%
                     (DETN)   (CAL FROM S)

                      19.28       18.52

           ***     ASH%     ASH%     ASH%
                  (DETN)   (CAL)   (CAL-UC)

                   24.25    21.21    26.28


 ****       BTU         BTU         BTU         BTU         BTU
           (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
           (MAF)                               (ADJ)        (MAF)

           12877        9754        9973        9588        10910


 *****      BTU RE      BTU RE        BTU RE      BTU RE
            -----PRODUCT-----         -----UPG COAL-----
                        (ADJ)                     (ADJ)
            138.00      143.54        90.77       94.41



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

DATA CHECKING

P1-M-1

```
                     *        YIELD%    YIELD%
                            (PRODUCT)  (UPG COAL)

                               86.90       76.47


                    **        RES%       RES%
                              (DETN)  (CAL FROM S)

                               12.00       15.76

                   ***     ASH%     ASH%     ASH%
                         (DETN)   (CAL)    (CAL-UC)

                          29.71    17.95    20.40

        ****         BTU          BTU          BTU          BTU          BTU
                    (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                    (MAF)                                  (ADJ)         (MAF)

                    12421         8731         9992         9560        11183


        *****       BTU RE      BTU RE        BTU RE      BTU RE
                    -----PRODUCT-----         -----UPG COAL-----
                                (ADJ)                      (ADJ)
                    107.18      125.11         81.44       95.06



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 86.90    12.00

 29.71     1.32    8731
```

DATA CHECKING

P2-M-2

```
 *          YIELD%     YIELD%
           (PRODUCT)  (UPG COAL)

            34.20       72.08


**          RES%       RES%
           (DETN)   (CAL FROM S)

            14.40       14.38

***     ASH%     ASH%     ASH%
       (DETN)   (CAL)    (CAL-UC)

        17.91    20.55    24.00


****        BTU        BTU        BTU        BTU        BTU
           (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
           (MAF)                            (ADJ)      (MAF)

            12497      10259      9990       10322      11122


*****       BTU RE     BTU RE       BTU RE     BTU RE
            -----PRODUCT-----       -----UPG COAL-----
                       (ADJ)                   (ADJ)
            122.89     119.95        92.75      89.77



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


34.20     14.40

17.91      1.36    10259
```

```
                         DATA  CHECKING

                               P3-M-3


                  *         YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                             91.10       76.71


                 **          RES%       RES%
                            (DETN)  (CAL FROM S)

                             15.80       15.76

                ***      ASH%     ASH%     ASH%
                       (DETN)   (CAL)   (CAL-UC)

                          22.16   22.28   26.46

         ****        BTU         BTU         BTU         BTU        BTU
                    (DETN)      (DETN)      (CAL)       (CAL)      (COAL)
                    (MAF)                               (ADJ)       (MAF)

                    12803        9966        9681        9696       10910


         *****       BTU RE      BTU RE       BTU RE      BTU RE
                     -----PRODUCT-----        -----UPG COAL-----
                                 (ADJ)                    (ADJ)
                     134.23      134.01        97.04       96.89




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 91.10    15.80

 22.16     1.48    9966
```

DATA CHECKING

P1-M-4

```
   *          YIELD%     YIELD%
             (PRODUCT)  (UPG COAL)

               95.20       74.55

  **          RES%       RES%
              (DETN)   (CAL FROM S)

              12.50        14.49

 ***      ASH%      ASH%      ASH%
         (DETN)    (CAL)     (CAL-UC)

          16.11    18.31     20.93

 ****         BTU         BTU         BTU         BTU         BTU
             (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
             (MAF)                               (ADJ)        (MAF)

             12400       10402       10035       10305       11183

 *****       BTU RE      BTU RE       BTU RE      BTU RE
             ------PRODUCT-----       -----UPG COAL-----
                         (ADJ)                    (ADJ)
             125.19      121.91        98.91       96.31
```

```
(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.20     12.50

 16.11      1.27    10402
```

```
                    DATA  CHECKING

                        P2-M-S


            *         YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      87.80       75.68


           **          RES%       RES%
                      (DETN)   (CAL FROM S)

                       13.80       12.56

          ***      ASH%    ASH%    ASH%
                  (DETN)  (CAL)   (CAL-UC)

                   19.97   19.70   22.86


 ****         BTU         BTU         BTU         BTU         BTU
              (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
              (MAF)                               (ADJ)        (MAF)

              12602       10085       9938        9905        11122


 *****        BTU RE      BTU RE        BTU RE      BTU RE
              -----PRODUCT-----         -----UPG COAL-----
                          (ADJ)                     (ADJ)
              125.97      126.39         95.85       96.17



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


  87.80    13.80

  19.97     1.29   10085
```

DATA CHECKING

P3-M-6

```
        *          YIELD%      YIELD%
                 (PRODUCT)   (UPG COAL)

                   89.50        74.11


       **          RES%         RES%
                  (DETN)    (CAL FROM S)

                   17.20        17.35

      ***     ASH%     ASH%     ASH%
             (DETN)   (CAL)   (CAL-UC)

              21.93    22.68    27.39


****        BTU        BTU        BTU        BTU        BTU
           (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
           (MAF)                            (ADJ)       (MAF)

           12785       9981       9810       9906       10910


*****      BTU RE     BTU RE        BTU RE     BTU RE
           -----PRODUCT-----        -----UPG COAL-----
                      (ADJ)                    (ADJ)
           132.07     130.80         92.30      91.41



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 89.50    17.20

 21.93     1.54     9981
```

DATA CHECKING

P1-M-7

```
  *          YIELD%     YIELD%
            (PRODUCT)  (UPG COAL)

              37.90       79.30


 **           RES%       RES%
             (DETN)   (CAL FROM S)

              9.78        13.99

***       ASH%      ASH%       ASH%
         (DETN)    (CAL)     (CAL-UC)

          21.56     17.75     19.67


****          BTU           BTU           BTU           BTU          BTU
             (DETN)        (DETN)        (CAL)         (CAL)        (COAL)
             (MAF)                                     (ADJ)         (MAF)

             12167          9544          9804          9349         11183


*****        BTU RE       BTU RE         BTU RE       BTU RE
             -----PRODUCT-----           -----UPG COAL-----
                          (ADJ)                       (ADJ)
             118.51       124.27          97.29       102.02



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 37.90      9.78

 21.56      1.25     9544
```

```
                         DATA  CHECKING

                              P2-M-8


                  *        YIELD%    YIELD%
                         (PRODUCT)  (UPG COAL)

                           38.80       77.08


                 **        RES%      RES%
                          (DETN)  (CAL FROM S)

                           13.20       14.38

                ***     ASH%    ASH%     ASH%
                       (DETN)  (CAL)   (CAL-UC)

                       18.12   19.48   22.44

       ****       BTU       BTU       BTU       BTU       BTU
                 (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
                 (MAF)                         (ADJ)      (MAF)

                 12421     10170      9886     10053     11122


       *****     BTU RE    BTU RE      BTU RE    BTU RE
                 -----PRODUCT-----     -----UPG COAL-----
                           (ADJ)                  (ADJ)
                 128.48    126.34       99.34     97.69



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 38.80    13.20

 18.12     1.36   10170
```

DATA CHECKING

```
                            P3-M-9

                *       YIELD%     YIELD%
                      (PRODUCT)  (UPG COAL)

                         94.60      76.72


               **        RES%       RES%
                        (DETN)   (CAL FROM S)

                         18.90      15.49

              ***     ASH%     ASH%      ASH%
                     (DETN)   (CAL)    (CAL-UC)

                     20.85    21.46    26.46


   ****       BTU        BTU        BTU        BTU        BTU
             (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
             (MAF)                            (ADJ)       (MAF)

             12786      10120       9968      10045      10910


   *****     BTU RE     BTU RE        BTU RE      BTU RE
             -----PRODUCT-----        -----UPG COAL-----
                        (ADJ)                     (ADJ)
             141.54     140.45         95.35       94.62



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.60    18.90

 20.85     1.47   10120
```

```
                         DATA CHECKING

                            P1-M-10


                   *       YIELD%    YIELD%
                         (PRODUCT)  (UPG COAL)

                           99.70       79.92


                  **        RES%       RES%
                           (DETN)  (CAL FROM S)

                           10.90        9.69

                 ***     ASH%     ASH%     ASH%
                        (DETN)   (CAL)   (CAL-UC)

                         20.77    17.39    19.52

         ****      BTU       BTU       BTU       BTU       BTU
                  (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
                  (MAF)                         (ADJ)      (MAF)

                  12129      9610      9899      9494      11183


         *****     BTU RE     BTU RE      BTU RE     BTU RE
                  -----PRODUCT-----       -----UPG COAL-----
                              (ADJ)                  (ADJ)
                  121.77     126.96       97.64     101.80



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 99.70    10.90

 20.77     1.08    9610
```

DATA CHECKING

```
                         P2-M-11


              *         YIELD%    YIELD%
                      (PRODUCT)  (UPG COAL)

                         95.70       79.72


             **          RES%      RES%
                        (DETN)  (CAL FROM S)

                         16.70       13.86

            ***      ASH%     ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                     21.64   18.08   21.70

    ****         BTU        BTU        BTU        BTU        BTU
                (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                (MAF)                            (ADJ)       (MAF)

                12443       9750       10191      9748       11122


    *****       BTU RE     BTU RE       BTU RE     BTU RE
                -----PRODUCT-----       -----UPG COAL-----
                           (ADJ)                   (ADJ)
                132.75     138.78        93.02      97.25



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.70    16.70

 21.64     1.34    9750
```

DATA CHECKING

P3-M-12

```
                *        YIELD%     YIELD%
                       (PRODUCT)  (UPG COAL)

                          99.60       78.19


               **          RES%        RES%
                          (DETN)   (CAL FROM S)

                          21.50       19.74

              ***      ASH%     ASH%      ASH%
                      (DETN)   (CAL)    (CAL-UC)

                      21.55    20.38     25.96


     ****        BTU         BTU         BTU         BTU         BTU
                 (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                 (MAF)                               (ADJ)       (MAF)

                 12709        9970       10208       10059       10910


     *****       BTU RE      BTU RE        BTU RE      BTU RE
                 -----PRODUCT-----         -----UPG COAL-----
                             (ADJ)                     (ADJ)
                 146.31      149.00         91.49       92.85



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED.VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 99.60    21.50

 21.55     1.63    9970
```

```
                         DATA  CHECKING

                             P1-M-13


                  *        YIELD%    YIELD%
                        (PRODUCT)  (UPG COAL)

                           90.60       77.73


                 **        RES%       RES%
                          (DETN)  (CAL FROM S)

                           14.20       13.73

                ***     ASH%    ASH%     ASH%
                      (DETN)   (CAL)   (CAL-UC)

                        25.25   17.22   20.07


       ****      BTU        BTU        BTU        BTU        BTU
                (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                (MAF)                            (ADJ)       (MAF)

                12428       9290      10179       9192      11183


       *****     BTU RE     BTU RE       BTU RE     BTU RE
                -----PRODUCT-----        -----UPG COAL-----
                            (ADJ)                     (ADJ)
                118.90     131.67        97.14       96.51



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 90.60    14.20

 25.25     1.24     9290
```

```
                              DATA  CHECKING

                                 P2-M-14


                         *        YIELD%     YIELD%
                                (PRODUCT)  (UPG COAL)

                                  91.40       80.52


                        **        RES%       RES%
                                 (DETN)   (CAL FROM S)

                                  11.90        9.70

                       ***     ASH%     ASH%     ASH%
                              (DETN)   (CAL)    (CAL-UC)

                               23.91    18.93    21.48


            ****          BTU        BTU         BTU        BTU        BTU
                         (DETN)     (DETN)      (CAL)      (CAL)      (COAL)
                         (MAF)                             (ADJ)       (MAF)

                         12295       9355        9772       9171       11122


            *****        BTU RE      BTU RE       BTU RE      BTU RE
                         -----PRODUCT-----        -----UPG COAL-----
                                     (ADJ)                    (ADJ)
                         121.65      129.61        94.61      100.80



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 91.40    11.90

 23.91     1.18    9355
```

```
                        DATA  CHECKING

                            P3-M-15


                   *        YIELD%     YIELD%
                         (PRODUCT)   (UPG COAL)

                            98.40        78.42


                  **        RES%       RES%
                           (DETN)   (CAL FROM S)

                            20.30        22.93

                 ***     ASH%     ASH%     ASH%
                        (DETN)   (CAL)    (CAL-UC)

                         21.73    20.63    25.88

         ****        BTU        BTU        BTU        BTU        BTU
                    (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                    (MAF)                            (ADJ)       (MAF)

                    12858      10064      10097       9957       10910


         *****       BTU RE     BTU RE      BTU RE     BTU RE
                     -----PRODUCT-----      -----UPG COAL-----
                                (ADJ)                  (ADJ)
                     146.41     148.46       94.81      96.14



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 98.40     20.30

 21.73      1.75    10064
```

DATA CHECKING

P1-M-16

```
                         *           YIELD%     YIELD%
                                   (PRODUCT)   (UPG COAL)

                                     90.60        81.51


                        **           RES%       RES%
                                     (DETN)   (CAL FROM S)

                                     10.03        13.99

                       ***       ASH%      ASH%      ASH%
                                (DETN)    (CAL)     (CAL-UC)

                                 13.66    17.22     19.14


          ****          BTU          BTU          BTU          BTU          BTU
                        (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                        (MAF)                                  (ADJ)         (MAF)

                        12041        10396        9825         10247        11183


          *****         BTU RE       BTU RE          BTU RE       BTU RE
                        -----PRODUCT-----            -----UPG COAL-----
                                     (ADJ)                        (ADJ)
                        133.05       127.57          110.62       106.06



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 90.60     10.03

 13.66      1.25    10396
```

```
                         DATA CHECKING

                              P2-M-17


                 *          YIELD%     YIELD%
                          (PRODUCT)   (UPG COAL)

                             94.00       81.12


                **          RES%        RES%
                           (DETN)   (CAL FROM S)

                            13.70       13.08

               ***      ASH%     ASH%     ASH%
                      (DETN)   (CAL)    (CAL-UC)

                       17.94    18.40    21.33


      ****         BTU        BTU        BTU        BTU        BTU
                  (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                  (MAF)                            (ADJ)       (MAF)

                  12378      10157      9929       9986       11122


      *****        BTU RE      BTU RE        BTU RE      BTU RE
                   -----PRODUCT-----         -----UPG COAL-----
                               (ADJ)                     (ADJ)
                   135.83      135.06        103.82      103.23




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.00    13.70

 17.94     1.31   10157
```

DATA CHECKING

P1-M-19

```
 *            YIELD%     YIELD%
            (PRODUCT)   (UPG COAL)

              99.30        80.03


 **           RES%        RES%
             (DETN)   (CAL FROM S)

              10.38        13.99

***       ASH%     ASH%      ASH%
         (DETN)   (CAL)    (CAL-UC)

          22.01    17.47    19.49


****        BTU        BTU        BTU        BTU        BTU
           (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
           (MAF)                            (ADJ)       (MAF)

           12653       9868       9855       9312      11183


*****      BTU RE      BTU RE       BTU RE      BTU RE
           -----PRODUCT-----        -----UPG COAL-----
                       (ADJ)                    (ADJ)
           124.48      131.73       101.60      107.52



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 99.30    10.38

 22.01     1.25    9868
```

```
                          DATA CHECKING

                              P2-M-20


                 *          YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                            95.80       73.96


                **          RES%       RES%
                           (DETN)   (CAL FROM S)

                            13.80      13.60

               ***      ASH%     ASH%     ASH%
                       (DETN)   (CAL)   (CAL-UC)

                        20.35    20.16    23.39


         ****     BTU        BTU        BTU        BTU        BTU
                 (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                 (MAF)                            (ADJ)       (MAF)

                 12986      10264      9938       9915       11122


         *****    BTU RE     BTU RE       BTU RE     BTU RE
                 -----PRODUCT-----       -----UPG COAL-----
                            (ADJ)                   (ADJ)
                 125.29     125.58        95.85      96.08



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.80    13.90

 20.35     1.33    10264
```

```
                      DATA CHECKING

                          P3-M-21


              *        YIELD%     YIELD%
                     (PRODUCT)  (UPG COAL)

                       93.10       75.69


             **        RES%        RES%
                       (DETN)   (CAL FROM S)

                       18.70       16.02

            ***     ASH%      ASH%      ASH%
                   (DETN)    (CAL)    (CAL-UC)

                    20.70     21.80     26.82


       ****      BTU         BTU         BTU         BTU         BTU
                (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                (MAF)                               (ADJ)        (MAF)

                12884       10217        9949       10090       10910


       *****     BTU RE      BTU RE        BTU RE      BTU RE
                 -----PRODUCT-----         -----UPG COAL-----
                             (ADJ)                      (ADJ)
                 140.63     138.67          95.65       94.32



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.10     18.70

 20.70      1.49    10217
```

```
                        DATA  CHECKING

                           P1-M-22


                *       YIELD%    YIELD%
                      (PRODUCT)  (UPG COAL)

                         98.30      78.15


               **        RES%       RES%
                        (DETN)   (CAL FROM S)

                         11.50      15.51

              ***     ASH%     ASH%     ASH%
                     (DETN)   (CAL)   (CAL-UC)

                      17.58    17.67    19.96


      ****      BTU        BTU        BTU        BTU        BTU
               (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
               (MAF)                            (ADJ)      (MAF)

               12771      10526      9950       9960      11183


      *****    BTU RE     BTU RE       BTU RE     BTU RE
               -----PRODUCT-----       -----UPG COAL-----
                          (ADJ)                   (ADJ)
               131.30     131.16       106.23     106.12



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 98.30     11.50

 17.58      1.31    10526
```

```
                        DATA  CHECKING

                                    P2-M-23


                        *        YIELD%    YIELD%
                               (PRODUCT)  (UPG COAL)

                                 93.70       73.57


                       **        RES%      RES%
                                 (DETN)  (CAL FROM S)

                                 12.10       10.22

                      ***     ASH%    ASH%    ASH%
                            (DETN)  (CAL)   (CAL-UC)

                              21.28   20.67   23.51

           ****          BTU       BTU       BTU       BTU       BTU
                        (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
                        (MAF)                         (ADJ)      (MAF)

                        12632      9944      9789      9714      11122


           *****        BTU RE     BTU RE      BTU RE     BTU RE
                        -----PRODUCT-----      -----UPG COAL-----
                                   (ADJ)                  (ADJ)
                        119.41     119.33       93.24      93.96



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.70    12.10

 21.28     1.20    9944
```

```
                    DATA CHECKING

                       P3-M-24


               *        YIELD%     YIELD%
                      (PRODUCT)  (UPG COAL)

                        92.60        74.91


              **        RES%        RES%
                        (DETN)   (CAL FROM S)

                        19.10        20.28

             ***     ASH%     ASH%      ASH%
                   (DETN)   (CAL)    (CAL-UC)

                    22.59    21.92    27.10


       ****        BTU        BTU        BTU        BTU        BTU
                   (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                   (MAF)                            (ADJ)       (MAF)

                   13126      10161      9986       9901       10910


       *****       BTU RE     BTU RE       BTU RE     BTU RE
                   -----PRODUCT-----       -----UPG COAL-----
                              (ADJ)                    (ADJ)
                   139.11     140.31       93.42       94.22



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 92.60    19.10

 22.59     1.65    10161
```

```
                    DATA CHECKING

                         P1-M-25


              *        YIELD%    YIELD%
                     (PRODUCT)  (UPG COAL)

                        89.70      77.23


             **         RES%      RES%
                       (DETN)  (CAL FROM S)

                        13.90      14.24

            ***      ASH%     ASH%     ASH%
                    (DETN)   (CAL)   (CAL-UC)

                     21.19    17.39    20.20

    ****        BTU        BTU        BTU        BTU        BTU
               (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
               (MAF)                            (ADJ)       (MAF)

               12951      10207      10154      9687       11183


    *****      BTU RE     BTU RE      BTU RE     BTU RE
               -----PRODUCT-----      -----UPG COAL-----
                          (ADJ)                  (ADJ)
               129.34     135.57       98.56     103.31


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 89.70    13.90

 21.19     1.26   10207
```

```
                    DATA  CHECKING

                        P3-M-27


                 *        YIELD%     YIELD%
                        (PRODUCT)  (UPG COAL)

                          91.40       75.86


                **        RES%       RES%
                         (DETN)   (CAL FROM S)

                          17.00       19.74

               ***     ASH%     ASH%      ASH%
                      (DETN)   (CAL)    (CAL-UC)

                       22.98    22.21     26.76


       ****        BTU        BTU        BTU        BTU        BTU
                  (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                  (MAF)                            (ADJ)      (MAF)

                  12991      10006       9792       9695      10910


       *****      BTU RE       BTU RE       BTU RE      BTU RE
                  -----PRODUCT-----         -----UPG COAL-----
                               (ADJ)                     (ADJ)
                  135.21       136.56       95.07       96.02



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 91.40    17.00

 22.98     1.63   10006
```

```
                         DATA  CHECKING

                              P1-E-1


                   *          YIELD%     YIELD%
                            (PRODUCT)  (UPG COAL)

                              95.80       92.48


                  **          RES%        RES%
                             (DETN)   (CAL FROM S)

                              13.90       12.79

                 ***       ASH%     ASH%      ASH%
                          (DETN)   (CAL)    (CAL-UC)

                          21.31    16.28    18.91


        ****        BTU          BTU         BTU         BTU         BTU
                   (DETN)       (DETN)      (CAL)       (CAL)      (COAL)
                   (MAF)                                (ADJ)       (MAF)

                   12210         9608       10205        8592       11193


        *****       BTU RE       BTU RE       BTU RE      BTU RE
                   -----PRODUCT-----         -----UPG COAL-----
                                 (ADJ)                    (ADJ)
                   130.02       138.33        86.46      102.62



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.80    13.90

 21.31     0.87    9608
```

```
                     DATA CHECKING

                         P1-E-3


             *         YIELD%     YIELD%
                     (PRODUCT)  (UPG COAL)

                        93.90       77.53


            **          RES%       RES%
                       (DETN)   (CAL FROM S)

                        17.43        7.61

           ***       ASH%     ASH%      ASH%
                    (DETN)   (CAL)    (CAL-UC)

                     18.19   16.61    20.12


    ****      BTU         BTU         BTU         BTU         BTU
             (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
             (MAF)                               (ADJ)       (MAF)

             12221        9998       10519       10319       11193


    *****     BTU RE      BTU RE        BTU RE       BTU RE
             -----PRODUCT-----          -----UPG COAL-----
                           (ADJ)                     (ADJ)
             135.62       135.19        91.77        93.13



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.90     17.43

 18.19      0.80     9998
```

DATA CHECKING

P1-E-7

```
   *          YIELD%    YIELD%
            (PRODUCT)  (UPG COAL)

              90.20       74.69


  **          RES%       RES%
             (DETN)   (CAL FROM S)

              17.20       19.47

 ***       ASH%     ASH%      ASH%
          (DETN)   (CAL)    (CAL-UC)

           16.79    17.29    20.89

****         BTU         BTU         BTU         BTU         BTU
            (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
            (MAF)                               (ADJ)       (MAF)

            12070       10058       10498       10617       11197


*****        BTU RE      BTU RE        BTU RE      BTU RE
             -----PRODUCT-----         -----UPG COAL-----
                          (ADJ)                     (ADJ)
             109.16      106.77        89.06       88.09
```

```
(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
 90.20    17.20

 16.79     0.96   10058
```

DATA CHECKING

P1-E-4

```
*              YIELD%     YIELD%
             (PRODUCT)  (UPG COAL)

                92.50       79.16


**              RES%       RES%
               (DETN)   (CAL FROM S)

                14.42        9.09

***         ASH%     ASH%      ASH%
           (DETN)   (CAL)    (CAL-UC)

            24.26    16.86    19.71


****          BTU         BTU        BTU        BTU        BTU
             (DETN)      (DETN)     (CAL)      (CAL)      (COAL)
             (MAF                              (ADJ)       (MAF)

             11929        8959      10251       9339       11193


*****        BTU RE      BTU RE       BTU RE      BTU RE
             -----PRODUCT-----        -----UPG COAL-----
                          (ADJ)                    (ADJ)
             117.77      128.50       83.45       91.59



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


92.50    14.42

24.26    0.92    8959
```

·7

DATA CHECKING

P2-E-5

```
*          YIELD%     YIELD%
          (PRODUCT)  (UPG COAL)

            93.80       77.54


**          RES%       RES%
           (DETN)   (CAL FROM S)

            17.33       19.52

***      ASH%     ASH%     ASH%
        (DETN)   (CAL)   (CAL-UC)

         21.98   18.44   22.31


****       BTU        BTU        BTU        BTU        BTU
          (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
          (MAF)                            (ADJ)      (MAF)

          11979       9346      10310       9863      11122


*****      BTU RE     BTU RE        BTU RE     BTU RE
           -----PRODUCT-----        -----UPG COAL-----
                      (ADJ)                    (ADJ)
           124.72     130.37         87.46      87.24



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.80    17.33

 21.98     1.05    9346
```

```
                           DATA  CHECKING

                                P2-E-4


                    *          YIELD%     YIELD%
                            (PRODUCT)   (UPG COAL)

                               95.40       78.70


                   **          RES%       RES%
                              (DETN)   (CAL FROM S)

                               17.51       13.99

                  ***       ASH%     ASH%      ASH%
                          (DETN)   (CAL)    (CAL-UC)

                           22.30   18.13    21.99


          ****        BTU          BTU         BTU          BTU          BTU
                     (DETN)       (DETN)      (CAL)        (CAL)        (COAL)
                     (MAF)                                 (ADJ)         (MAF)

                     12019         9335       10327         9801         11122


          *****      BTU RE       BTU RE        BTU RE       BTU RE
                     -----PRODUCT-----          -----UPG COAL-----
                                  (ADJ)                      (ADJ)
                     126.74       133.53         84.34        88.86



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.40     17.51

 22.30      0.98    9339
```

DATA CHECKING

```
                    P2-E-7


     *          YIELD%     YIELD%
              (PRODUCT)  (UPG COAL)

                 93.10       78.79


    **           RES%       RES%
                (DETN)   (CAL FROM S)

                 15.37       11.47

   ***        ASH%     ASH%     ASH%
            (DETN)   (CAL)    (CAL-UC)

             22.12    18.58    21.96


****      BTU        BTU        BTU        BTU        BTU
         (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
         (MAF)                            (ADJ)      (MAF)

         12013       9356      10132       9692      11122


*****     BTU RE      BTU RE        BTU RE      BTU RE
          -----PRODUCT-----         -----UPG COAL-----
                      (ADJ                     (ADJ)
          123.92      129.55        87.60       91.58




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.10    15.37

 22.12     0.95    9356
```

DATA CHECKING

```
                         P2-E-9


            *         YIELD%     YIELD%
                    (PRODUCT)   (UPG COAL)

                      39.30       73.30


           **         RES%       RES%
                      (DETN)   (CAL FROM S)

                      17.92       13.89

          ***      ASH%     ASH%      ASH%
                 (DETN)    (CAL)    (CAL-UC)

                   21.49    19.37    23.60


   ****         BTU        BTU        BTU        BTU        BTU
               (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
               (MAF)                            (ADJ)       (MAF)

               11807       9270      10364      10092      11122


   *****        BTU RE     BTU RE       BTU RE     BTU RE
                -----PRODUCT-----       -----UPG COAL-----
                           (ADJ                    (ADJ)
                117.77     120.95        77.15      79.22



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 39.30    17.92

 21.49     0.98    9270
```

```
                      DATA  CHECKING

                           P1-E-9


                    *         YIELD%    YIELD%
                            (PRODUCT)  (UPG COAL)

                              90.70       76.82


                   **         RES%       RES%
                              (DETN)  (CAL FROM S)

                              15.30       14.26

                  ***     ASH%    ASH%    ASH%
                         (DETN)  (CAL)   (CAL-UC)

                          17.35   17.20   20.31


        ****         BTU        BTU        BTU        BTU        BTU
                    (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                    (MAF)                            (ADJ)       (MAF)

                    12234      10111      10329      10310      11193


        *****        BTU RE     BTU RE      BTU RE     BTU RE
                    -----PRODUCT-----      -----UPG COAL-----
                               (ADJ)                  (ADJ)
                    129.55     129.78       94.57      94.74



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 90.70    15.30

 17.35     0.89    10111
```

DATA CHECKING

```
                         P1-E-10

            *          YIELD%     YIELD%
                     (PRODUCT)  (UPG COAL)

                        98.90       76.63

           **           RES%       RES%
                       (DETN)   (CAL FROM S)

                        13.80        7.61

          ***       ASH%     ASH%      ASH%
                   (DETN)   (CAL)    (CAL-UC)

                   18.73    17.55     20.36

    ****       BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
              (MAF)                            (ADJ)      (MAF)

              12079       9817      10196      10050      11193


    *****      BTU RE     BTU RE      BTU RE     BTU RE
              -----PRODUCT-----      -----UPG COAL-----
                           (ADJ)                 (ADJ)
              123.39      125.09       92.76      93.71


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 98.90    13.80

 18.73    0.80     9817
           .9
```

```
                        DATA CHECKING

                           P2-E-13


                    *         YIELD%     YIELD%
                            (PRODUCT)  (UPG COAL)

                              90.00       76.66


                   **          RES%       RES%
                              (DETN)  (CAL FROM S)

                              14.92       12.29

                  ***      ASH%     ASH%     ASH%
                          (DETN)   (CAL)   (CAL-UC)

                           18.84   19.22    22.57


            ****      BTU        BTU        BTU        BTU        BTU
                     (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
                     (MAF)                            (ADJ)      (MAF)

                     12234       9929      10082      10130      11122


            *****     BTU RE     BTU RE       BTU RE     BTU RE
                     -----PRODUCT-----        -----UPG COAL-----
                     .          (ADJ)                    (ADJ)
                     127.13     126.53        97.29      96.84




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
 DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
 ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY



 90.00    14.92

 18.84    0.96    9929
```

DATA CHECKING

```
                          P3-E-14


              *       YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      88.00       76.23


             **       RES%       RES%
                     (DETN)   (CAL FROM S)

                      13.38       13.08

            ***    ASH%     ASH%     ASH%
                  (DETN)   (CAL)    (CAL-UC)

                   21.81   19.66    22.70


     ****     BTU       BTU       BTU       BTU       BTU
             (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
             (MAF)                         (ADJ)     (MAF)

             10014      9394      9951      9684     11122


     *****    BTU RE    BTU RE      BTU RE    BTU RE
             -----PRODUCT-----      -----UPG COAL-----
                        (ADJ)                 (ADJ)
             117.61    120.94       87.72     90.13



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 88.00    13.38

 21.81     0.97    9394
```

DATA CHECKING

```
                         P2-E-13


               *        YIELD%     YIELD%
                      (PRODUCT)  (UPG COAL)

                         34.90       69.87


              **         RES%       RES%
                        (DETN)   (CAL FROM S)

                         17.70       14.69

             ***      ASH%     ASH%     ASH%
                     (DETN)   (CAL)    (CAL-UC)

                      19.67    20.38    24.76


    ****        BTU          BTU         BTU          BTU          BTU
               (DETN)       (DETN)      (CAL)        (CAL)        (COAL)
               (MAF)                                 (ADJ)        (MAF)

               12251         9941       10344        10436        11122


    *****      BTU RE      BTU RE         BTU RE      BTU RE
               -----PRODUCT-----          -----UPG COAL-----
                            (ADJ)                      (ADJ)
               118.86      117.82          80.72       80.01



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 34.90    17.70

 19.67     0.99    9941
```

```
                              DATA CHECKING

                                 P2-E-16


                        *       YIELD%     YIELD%
                              (PRODUCT)  (UPG COAL)

                                 90.90        76.75


                       **        RES%       RES%
                                (DETN)   (CAL FROM S)

                                 15.57        13.89

                      ***     ASH%     ASH%     ASH%
                             (DETN)   (CAL)   (CAL-UC)

                              17.48   19.03   22.54


            ****        BTU        BTU        BTU        BTU        BTU
                       (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                       (MAF)                            (ADJ)       (MAF)

                       12249      10108      10150      10345      11122


            *****      BTU RE     BTU RE       BTU RE     BTU RE
                       -----PRODUCT-----       -----UPG COAL-----
                                   (ADJ)                  (ADJ)
                       130.72     128.26        94.79      93.01



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 90.90    15.57

 17.48     0.98   10108
```

```
                    DATA  CHECKING

                         P2-E-19


            *        YIELD%    YIELD%
                   (PRODUCT)  (UPG COAL)

                     39.60       74.05


           **        RES%       RES%
                     (DETN)   (CAL FROM S)

                     17.36       15.50

          ***      ASH%     ASH%      ASH%
                  (DETN)   (CAL)    (CAL-UC)

                   21.56    19.31    23.36


 ****        BTU         BTU        BTU        BTU        BTU
            (DETN)      (DETN)     (CAL)      (CAL)     (COAL)
            (MAF)                             (ADJ)      (MAF)

            11836         9294     10313      10023      11122


 *****      BTU RE     BTU RE        BTU RE     BTU RE
            -----PRODUCT-----        -----UPG COAL-----
                       (ADJ)                    (ADJ)
            118.34     121.74         78.86      81.13



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 39.60    17.36

 21.56     1.00    9294
```

```
                        DATA  CHECKING

                           P2-E-20


                    *         YIELD%    YIELD%
                           (PRODUCT)  (UPG COAL)

                               87.90       72.90


                   **          RES%       RES%
                              (DETN)   (CAL FROM S)

                               17.07       17.11

                  ***      ASH%     ASH%     ASH%
                          (DETN)   (CAL)   (CAL-UC)

                          18.31    19.68   13.73

          ****      BTU          BTU          BTU          BTU          BTU
                   (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                   (MAF)                                  (ADJ)        (MAF)

                   12114         9896        10297        10462        11122


          *****     BTU RE      BTU RE        BTU RE      BTU RE
                    -----PRODUCT-----         -----UPG COAL-----
                                 (ADJ)                     (ADJ)
                    122.75      121.68        83.67       84.22



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 37.90    17.07

 18.31     1.02    9896
```

DATA CHECKING

```
                               C1-D-1


                 *        YIELD%     YIELD%
                        (PRODUCT)  (UPG COAL)

                          96.40       87.43


                **        RES%       RES%
                         (DETN)   (CAL FROM S)

                          9.30     (SULFUR NOT ANALYZED)


               ***     ASH%     ASH%     ASH%
                     (DETN)    (CAL)   (CAL-UC)

                        10.56    11.10    12.24


        ****       BTU         BTU         BTU         BTU         BTU
                  (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                  (MAF)                               (ADJ)        (MAF)

                  13729       12278       12625       12701       13690


        *****      BTU RE      BTU RE        BTU RE      BTU RE
                  -----PRODUCT-----          -----UPG COAL-----
                                (ADJ)                      (ADJ)
                  102.92      102.30          99.42       98.98



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


96.40     9.30

10.56     0.00    12278
```

```
                    DATA CHECKING

                          C2-D-2


                  *         YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                             92.80       84.34


                 **          RES%        RES%
                            (DETN)   (CAL FROM S)

                              9.12     (SULFUR NOT ANALYZED)


                ***      ASH%      ASH%      ASH%
                        (DETN)    (CAL)    (CAL-UC)

                         10.19    11.53     12.69


       ****          BTU          BTU          BTU          BTU          BTU
                    (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                    (MAF)                                  (ADJ)         (MAF)

                    13385        12021        12591        12782        13659


       *****         BTU RE       BTU RE         BTU RE       BTU RE
                    -----PRODUCT-----           -----UPG COAL-----
                                  (ADJ)                       (ADJ)
                     97.11        95.66          84.36        83.10



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 92.80     9.12

 10.19     0.00    12021
```

```
                    DATA CHECKING

                        C1-D-3


                *        YIELD%     YIELD%
                       (PRODUCT)  (UPG COAL)

                         96.20       87.06


               **        RES%       RES%
                        (DETN)   (CAL FROM S)

                         9.50     (SULFUR NOT ANALYZED)


              ***     ASH%     ASH%     ASH%
                     (DETN)   (CAL)   (CAL-UC)

                      13.27   11.12    12.29


      ****      BTU        BTU        BTU       BTU       BTU
               (DETN)     (DETN)     (CAL)     (CAL)     (COAL)
               (MAF)                           (ADJ)      (MAF)

               13782      11953      12635     12330     13690


      *****     BTU RE     BTU RE       BTU RE    BTU RE
               -----PRODUCT-----       -----UPG COAL-----
                          (ADJ)                   (ADJ)
                99.99     102.47        86.23     88.36



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.20     9.50

 13.27     0.00    11953
```

DATA CHECKING

C2-D-4

```
               *          YIELD%     YIELD%
                        (PRODUCT)   (UPG COAL)

                          97.70        99.98


              **          RES%       RES%
                          (DETN)   (CAL FROM S)

                           7.90      (SULFUR NOT ANALYZED)


             ***       ASH%     ASH%      ASH%
                      (DETN)   (CAL)    (CAL-UC)

                       10.71    10.95     11.89


       ****          BTU        BTU        BTU        BTU        BTU
                    (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                    (MAF)                            (ADJ)       (MAF)

                    13642      12181      12529      12562      13659


       *****         BTU RE      BTU RE       BTU RE      BTU RE
                    -----PRODUCT-----         -----UPG COAL-----
                                 (ADJ)                     (ADJ)
                    103.60      103.32        91.97       91.72


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 97.70      7.90

 10.71      0.00     12181
```

DATA CHECKING

```
                         R1-D-1

        *          YIELD%     YIELD%
                 (PRODUCT)  (UPG COAL)

                   94.00        83.03

       **          RES%       RES%
                  (DETN)   (CAL FROM S)

                   11.67    (SULFUR NOT ANALYZED)

      ***       ASH%     ASH%     ASH%
               (DETN)   (CAL)   (CAL-UC)

                 9.41   10.85    12.28

****        BTU        BTU        BTU        BTU        BTU
           (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
           (MAF)                            (ADJ)       (MAF)

            12381      11216      11586      11773      12163

*****       BTU RE      BTU RE       BTU RE      BTU RE
            ------PRODUCT-----       -----UPG COAL-----
                        (ADJ)                    (ADJ)
            104.69      103.02       85.83       84.46

(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY

 94.00    11.67

  9.41     0.00   11216
```

```
                  DATA  CHECKING

                             R2-D-2


                  *         YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                            93.00      81.15


                 **         RES%       RES%
                           (DETN)   (CAL FROM S)

                            12.74     (SULFUR NOT ANALYZED)


                ***      ASH%     ASH%     ASH%
                        (DETN)   (CAL)    (CAL-UC)

                         10.62    10.11    11.58


         ****        BTU         BTU         BTU         BTU         BTU
                    (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                    (MAF)                               (ADJ)        (MAF)

                    12130       10842       11716       11650       12126


         *****       BTU RE      BTU RE        BTU RE      BTU RE
                    -----PRODUCT-----          -----UPG COAL-----
                                 (ADJ)                      (ADJ)
                     99.59      100.16          79.32       79.78


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.00     12.74

 10.62      0.00    10842
```

```
                    DATA CHECKING

                        R1-D-3


                *        YIELD%     YIELD%
                       (PRODUCT)  (UPG COAL)

                         96.10       86.49


               **        RES%       RES%
                         (DETN)   (CAL FROM S)

                         10.00    (SULFUR NOT ANALYZED)


              ***     ASH%     ASH%     ASH%
                     (DETN)   (CAL)   (CAL-UC)

                      14.23   10.61    11.79


        ****     BTU        BTU        BTU        BTU        BTU
                 (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                 (MAF)                            (ADJ)      (MAF)

                 12171      10439      11478      11013      12163


        *****    BTU RE     BTU RE       BTU RE     BTU RE
                 -----PRODUCT-----       -----UPG COAL-----
                            (ADJ)                   (ADJ)
                  99.61     103.81        83.09      86.59



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.10    10.00

 14.23     0.00    10439
```

```
                 DATA CHECKING

                      R2-D-4


           *          YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      96.10      88.53


          **          RES%       RES%
                     (DETN)   (CAL FROM S)

                      7.88     (SULFUR NOT ANALYZED)


         ***      ASH%     ASH%      ASH%
                 (DETN)   (CAL)    (CAL-UC)

                  12.92    9.78     10.62


****          BTU          BTU         BTU         BTU         BTU
             (DETN)       (DETN)      (CAL)       (CAL)       (COAL)
             (MAF)                                (ADJ)        (MAF)

             12192        10617       11404       11008       12126


*****         BTU RE      BTU RE        BTU RE      BTU RE
             -----PRODUCT-----         -----UPG COAL-----
                          (ADJ)                     (ADJ)
             100.77       104.40        87.82       90.98



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


96.10      7.88

12.92      0.00    10617
```

```
                    DATA  CHECKING

                         T1-D-1


              *       YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      95.70      86.88


             **       RES%       RES%
                     (DETN)   (CAL FROM S)

                      9.22        3.06

            ***    ASH%     ASH%     ASH%
                  (DETN)   (CAL)   (CAL-UC)

                   32.87    33.23    36.60


   ****        BTU       BTU       BTU       BTU       BTU
              (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
              (MAF)                         (ADJ)      (MAF)

              13020      8740      9282      9332      12740



   *****      BTU RE     BTU RE        BTU RE     BTU RE
              -----PRODUCT-----        -----UPG COAL-----
                         (ADJ)                    (ADJ)
              104.21     103.66        95.18      94.72



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.70     9.22

 32.87     0.60    8740
```

```
                     DATA  CHECKING

                          T2-D-3


               *          YIELD%    YIELD%
                        (PRODUCT)  (UPG COAL)

                          97.20       91.05


              **          RES%       RES%
                         (DETN)   (CAL FROM S)

                          6.33     (SULFUR NOT ANALYZED)


             ***      ASH%     ASH%     ASH%
                     (DETN)   (CAL)   (CAL-UC)

                      35.03    32.51   34.71


      ****          BTU         BTU         BTU         BTU         BTU
                   (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                   (MAF)                               (ADJ)       (MAF)

                   13121        8525        9142        9801       12979


      *****         BTU RE      BTU RE        BTU RE      BTU RE
                    -----PRODUCT-----         -----UPG COAL-----
                                 (ADJ)                     (ADJ)
                    101.65      105.59        88.58       92.01



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 97.20     6.33

 35.03     0.00     8525
```

DATA CHECKING

T1-D-3

```
                    *         YIELD%     YIELD%
                            (PRODUCT)  (UPG COAL)

                              96.60       98.98


                   **         RES%        RES%
                             (DETN)   (CAL FROM S)

                               7.89     (SULFUR NOT ANALYZED)


                  ***      ASH%     ASH%      ASH%
                          (DETN)   (CAL)    (CAL-UC)

                          30.65    32.92    35.74


      ****         BTU          BTU          BTU          BTU         BTU
                  (DETN)       (DETN)       (CAL)        (CAL)       (COAL)
                  (MAF)                                  (ADJ)       (MAF)

                  13080         9071         9164         9475        12740


      *****        BTU RE      BTU RE        BTU RE      BTU RE
                  -----PRODUCT-----         -----UPG COAL-----
                               (ADJ)                    (ADJ)
                  109.18      105.61        92.77       89.70



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.60      7.89

 30.65      0.00      9071
```

```
                  DATA CHECKING

                       T2-D-4


            *       YIELD%    YIELD%
                  (PRODUCT)  (UPG COAL)

                     97.40      39.72


           **        RES%      RES%
                    (DETN)   (CAL FROM S)

                     7.88     (SULFUR NOT ANALYZED


          ***     ASH%     ASH%     ASH%
                (DETN)   (CAL)    (CAL-UC)

                  36.69   32.44    35.22


     ****         BTU        BTU        BTU        BTU        BT
                 (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                 (MAF)                            (ADJ)      (MAF

                 12965       8145       9279       9695       12978


     *****        BTU RE     BTU RE       BTU RE     BTU RE
                 -----PRODUCT-----        -----UPG COAL-----
                             (ADJ)                   (ADJ)
                  97.32      103.84       81.01      86.45



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 97.40     7.88

 36.69     0.00    8145
```

```
                     DATA  CHECKING

                         C1-E-1


               *        YIELD%     YIELD%
                      (PRODUCT)   (UPG COAL)

                        95.70        85.50


              **        RES%       RES%
                        (DETN)    (CAL FROM S)

                        10.66      (SULFUR NOT ANALYZED)


             ***     ASH%      ASH%      ASH%
                    (DETN)    (CAL)     (CAL-UC)

                      10.95     11.18     12.51


       ****       BTU          BTU          BTU          BTU          BTU
                 (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                 (MAF)                                  (ADJ)         (MAF)

                 13763        12256        12751        12784        13690


       *****      BTU RE       BTU RE        BTU RE       BTU RE
                 -----PRODUCT-----           -----UPG COAL-----
                              (ADJ)                       (ADJ)
                 101.99       101.73         86.16        85.94


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.70     10.66

 10.95      0.00    12256
```

```
                         DATA CHECKING

                            C2-E-2


                  *         YIELD%     YIELD%
                          (PRODUCT)  (UPG COAL)

                            97.00       87.74


                 **          RES%       RES%
                            (DETN)   (CAL FROM S)

                             9.55      (SULFUR NOT ANALYZED)


                ***       ASH%      ASH%       ASH%
                         (DETN)    (CAL)     (CAL-UC)

                          11.94     11.03     12.20


       ****          BTU         BTU         BTU         BTU         BTU
                    (DETN)      (DETN)      (CAL)       (CAL)      (COAL)
                    (MAF)                               (ADJ)       (MAF)

                    13836       12184       12664       12534       13659


       *****        BTU RE      BTU RE       BTU RE      BTU RE
                    -----PRODUCT-----        -----UPG COAL-----
                                (ADJ)                    (ADJ)
                    102.89      103.95        88.50       89.41



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 97.00      9.55

 11.94      0.00    12184
```

```
                DATA CHECKING

                     C1-E-3


             *        YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      95.90       85.69


             **       RES%      RES%
                      (DETN)   (CAL FROM S)

                      10.65     (SULFUR NOT ANALYZED)


            ***     ASH%     ASH%     ASH%
                  (DETN)   (CAL)   (CAL-UC)

                   11.14    11.16    12.49


     ****       BTU        BTU        BTU        BTU        BTU
                (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                (MAF)                            (ADJ)      (MAF)

                13758      12225      12750      12753      13690


     *****      BTU RE     BTU RE       BTU RE     BTU RE
                -----PRODUCT-----       -----UPG COAL-----
                           (ADJ)                   (ADJ)
                101.95     101.93        86.10      86.08



UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
TU RE---BTU RECOVERY


95.90     10.65

11.14      0.00    12225
```

```
                    DATA  CHECKING

                          C2-E-4


              *        YIELD%    YIELD%
                     (PRODUCT)  (UPG COAL)

                        96.70      88.41


             **         RES%       RES%
                       (DETN)   (CAL FROM S)

                        8.57     (SULFUR NOT ANALYZED)


            ***     ASH%     ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                    10.95    11.07    12.10


    ****         BTU        BTU        BTU        BTU        BTU
                (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                (MAF)                            (ADJ)       (MAF)

                13704      12203      12608      12624      13659


    *****       BTU RE      BTU RE        BTU RE     BTU RE
                -----PRODUCT-----         -----UPG COAL-----
                           (ADJ)                     (ADJ)
                102.73     102.59         99.86      99.74



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.70     8.57

 10.95     0.00    12203
```

DATA CHECKING

```
                          R1-E-1

             *        YIELD%     YIELD%
                    (PRODUCT)  (UPG COAL)

                      95.30       88.24


            **        RES%       RES%
                     (DETN)   (CAL FROM S)

                      7.41      (SULFUR NOT ANALYZED)


           ***     ASH%     ASH%     ASH%
                  (DETN)   (CAL)   (CAL-UC)

                  10.85    10.70    11.56


 ****        BTU        BTU        BTU        BTU        BTU
            (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
            (MAF)                            (ADJ)       (MAF)

            12229      10902      11349      11330      12163


 *****      BTU RE     BTU RE        BTU RE     BTU RE
            -----PRODUCT-----        -----UPG COAL-----
                       (ADJ)                    (ADJ)
            103.16     103.33         90.65      90.80



UPG COAL)---THE COAL PORTION OF THE PRODUCT
DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


95.30     7.41

10.85     0.00    10902
```

DATA CHECKING

R2-E-2

```
                 *        YIELD%     YIELD%
                        (PRODUCT)   (UPG COAL)

                          96.10       89.51


                **        RES%        RES%
                          (DETN)   (CAL FROM S)

                           6.86     (SULFUR NOT ANALYZED)


               ***      ASH%       ASH%       ASH%
                      (DETN)     (CAL)     (CAL-UC)

                        11.29      9.78     10.50


        ****         BTU          BTU          BTU          BTU          BTU
                   (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                   (MAF)                                  (ADJ)         (MAF)

                   12016        10659        11375        11185        12126


        *****      BTU RE       BTU RE        BTU RE       BTU RE
                   -----PRODUCT-----          -----UPG COAL-----
                                (ADJ)                      (ADJ)
                   101.17       102.89         89.55        91.07



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.10      6.86

 11.29      0.00    10659
```

```
                    DATA CHECKING

                         R1-E-3


               *        YIELD%     YIELD%
                      (PRODUCT)  (UPG COAL)

                         94.20       87.10


              **         RES%       RES%
                        (DETN)   (CAL FROM S)

                          7.54     (SULFUR NOT ANALYZED)


             ***      ASH%     ASH%      ASH%
                    (DETN)   (CAL)    (CAL-UC)

                      9.40    10.83     11.71


      ****          BTU        BTU        BTU        BTU        BTU
                   (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                   (MAF)                            (ADJ)       (MAF)

                   12255      11103      11358      11540      12163


      *****        BTU RE      BTU RE       BTU RE      BTU RE
                   -----PRODUCT-----        -----UPG COAL-----
                               (ADJ)                    (ADJ)
                   103.95      102.22        91.27       99.83


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.20      7.54

  9.40      0.00    11103
```

```
                    DATA  CHECKING

                            R2-E-4


                 *          YIELD%    YIELD%
                         (PRODUCT)  (UPG COAL)

                            93.80      96.81


                **          RES%      RES%
                           (DETN)   (CAL FROM S)

                            7.45     (SULFUR NOT ANALYZED)


               ***       ASH%     ASH%      ASH%
                        (DETN)   (CAL)    (CAL-UC)

                         10.07    10.02     10.83


        ****        BTU         BTU         BTU         BTU         BTU
                   (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
                   (MAF)                               (ADJ)        (MAF)

                   12371       11125       11416       11410       12126


        *****       BTU RE      BTU RE        BTU RE      BTU RE
                    -----PRODUCT-----         -----UPG COAL-----
                                (ADJ)                      (ADJ)
                    103.06      103.12         90.75        90.80



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.80      7.45

 10.07      0.00    11125
```

```
                    DATA CHECKING

                        T1-E-1


               *        YIELD%     YIELD%
                      (PRODUCT)  (UPG COAL)

                        97.70       86.30


              **        RES%        RES%
                       (DETN)   (CAL FROM S)

                        11.67     (SULFUR NOT ANALYZED)


             ***     ASH%     ASH%     ASH%
                    (DETN)   (CAL)   (CAL-UC)

                    36.05    32.55    36.85


        ****        BTU        BTU        BTU        BTU        BTU
                   (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
                   (MAF)                            (ADJ)      (MAF)

                   12566       8036       9560       9064      12740


        *****      BTU RE     BTU RE        BTU RE     BTU RE
                   -----PRODUCT-----        -----UPG COAL-----
                               (ADJ)                   (ADJ)
                    97.82     103.18         72.48      76.44



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 97.70     11.67

 36.05      0.00     8036
```

```
                         DATA  CHECKING

                              T2-E-2


                 *          YIELD%     YIELD%
                          (PRODUCT)  (UPG COAL)

                            96.80       89.38


                **          RES%       RES%
                           (DETN)   (CAL FROM S)

                            7.67     (SULFUR NOT ANALYZED)


               ***      ASH%      ASH%      ASH%
                       (DETN)    (CAL)    (CAL-UC)

                        35.08     32.64    35.36


      ****        BTU          BTU          BTU          BTU          BTU
                 (DETN)       (DETN)       (CAL)        (CAL)       (COAL)
                 (MAF)                                  (ADJ)        (MAF)

                 12700         8245         9300         8963        12878


      *****       BTU RE       BTU RE        BTU RE       BTU RE
                 -----PRODUCT-----          -----UPG COAL-----
                              (ADJ)                       (ADJ)
                  97.90       101.58         81.65        84.72


(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


96.80     7.67

35.08     0.00     8245
```

```
                    DATA CHECKING

                        T1-E-3


              *        YIELD%     YIELD%
                     (PRODUCT)   (UPG COAL)

                        96.30       89.12


             **         RES%        RES%
                       (DETN)   (CAL FROM S)

                        7.46     (SULFUR NOT ANALYZED)


            ***      ASH%     ASH%     ASH%
                    (DETN)   (CAL)    (CAL-UC)

                     34.46    33.02    35.68


      ****      BTU        BTU        BTU        BTU        BTU
               (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
               (MAF)                            (ADJ)       (MAF)

               12739       8349       9166       8969       12740


      *****    BTU RE     BTU RE         BTU RE     BTU RE
               -----PRODUCT-----         -----UPG COAL-----
                          (ADJ)                      (ADJ)
               100.18     102.37          94.21      86.05



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.30      7.46

 34.46      0.00      8349
```

DATA CHECKING

```
                         T2-E-4


          *          YIELD%     YIELD%
                   (PRODUCT)  (UPG COAL)

                     96.70      88.93


         **          RES%       RES%
                    (DETN)   (CAL FROM S)

                      8.04     (SULFUR NOT ANALYZED)


        ***      ASH%     ASH%      ASH%
                (DETN)   (CAL)    (CAL-UC)

                 32.21    32.68     35.54


 ****      BTU        BTU        BTU        BTU        BTU
          (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
          (MAF)                            (ADJ)      (MAF)

          12891       8739       9334       9399      12878


 *****     BTU RE      BTU RE       BTU RE      BTU RE
           -----PRODUCT-----        -----UPG COAL-----
                        (ADJ)                    (ADJ)
           103.66      102.95       86.65       86.05



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.70      8.04

 32.21      0.00      8739
```

DATA CHECKING

```
                         T1-M-1A

              *       YIELD%     YIELD%
                     (PRODUCT)  (UPG COAL)

                       96.20      88.05


             **        RES%       RES%
                       (DETN)   (CAL FROM S)

                       8.47       10.83

            ***     ASH%     ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                    34.42    33.06    36.12


    ****        BTU        BTU        BTU        BTU        BTU
                (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                (MAF)                            (ADJ)      (MAF)

                13077      8576       9229       9041       12740


    *****       BTU RE     BTU RE        BTU RE     BTU RE
                -----PRODUCT-----        -----UPG COAL-----
                           (ADJ)                    (ADJ)
                102.79     104.93        85.05      86.82



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.20      8.47

 34.42      0.88      8576
```

```
                  DATA CHECKING

                      T2-M-2A


              *        YIELD%     YIELD%
                     (PRODUCT)  (UPG COAL)

                       97.70       89.98


             **        RES%        RES%
                      (DETN)  (CAL FROM S)

                        7.90       11.57

            ***     ASH%     ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                   35.86    32.34    35.12


     ****       BTU        BTU        BTU        BTU        BTU
               (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
               (MAF)                            (ADJ)       (MAF)

               13099       8402       9292       8809      12878


     *****     BTU RE     BTU RE     BTU RE     BTU RE
               -----PRODUCT-----     -----UPG COAL-----
                          (ADJ)                 (ADJ)
               100.70     106.22      84.15      88.77



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 97.70     7.90

 35.86     0.92     8402
```

```
                    DATA  CHECKING

                          T1-M-3A


                   *      YIELD%    YIELD%
                        (PRODUCT)  (UPG COAL)

                          98.30      88.94


                  **      RES%       RES%
                         (DETN)   (CAL FROM S)

                          9.52       11.54

                 ***    ASH%     ASH%      ASH%
                       (DETN)   (CAL)    (CAL-UC)

                       31.06    32.35    35.75


          ****     BTU        BTU        BTU        BTU        BTU
                  (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                  (MAF)                            (ADJ)       (MAF)

                  13090       9024       9324       9501      12740


          *****    BTU RE     BTU RE        BTU RE     BTU RE
                   -----PRODUCT-----        -----UPG COAL-----
                               (ADJ)                   (ADJ)
                   110.52     108.46        90.15      88.46



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 98.30     9.52

 31.06     0.91    9024
```

DATA CHECKING

```
                    T2-M-4A


         *       YIELD%    YIELD%
               (PRODUCT)  (UPG COAL)

                 94.90      86.33


        **       RES%      RES%
                 (DETN)   (CAL FROM S)

                  9.03      11.33

       ***     ASH%     ASH%     ASH%
              (DETN)   (CAL)   (CAL-UC)

               31.58    33.30    36.60


****         BTU        BTU        BTU         BTU         BTU
            (DETN)     (DETN)     (CAL)       (CAL)      (COAL)
            (MAF)                             (ADJ)       (MAF)

            12976       8878       9392        9634       12878


*****       BTU RE      BTU RE       BTU RE      BTU RE
            -----PRODUCT-----        -----UPG COAL-----
                        (ADJ)                    (ADJ)
            103.35      100.76        84.98       82.85



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.90      9.03

 31.58      0.91     8878
```

```
                    DATA  CHECKING

                         R1-M-5A


             *        YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      94.40       85.77


            **         RES%       RES%
                      (DETN)  (CAL FROM S)

                       9.14       11.63

           ***     ASH%     ASH%      ASH%
                  (DETN)   (CAL)    (CAL-UC

                   12.45   10.81    11.89


     ****      BTU        BTU        BTU        BTU        BTU
              (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
              (MAF)                            (ADJ)       (MAF)

              12493      10938      11436      11225      12163


     *****    BTU RE      BTU RE        BTU RE      BTU RE
              -----PRODUCT-----         -----UPG COAL-----
                          (ADJ)                    (ADJ)
              102.53      104.45         87.56       89.20



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.40      9.14

 12.45      1.13    10938
```

```
                         DATA  CHECKING

                              R2-M-6A

                  *        YIELD%     YIELD%
                         (PRODUCT)  (UPG COAL)

                           95.40       86.73


                 **        RES%       RES%
                          (DETN)   (CAL FROM S)

                            9.09       12.89

                ***     ASH%     ASH%     ASH%
                       (DETN)   (CAL)   (CAL-UC)

                        11.67    9.85    10.84


         ****       BTU        BTU        BTU        BTU        BTU
                   (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                   (MAF)                            (ADJ)      (MAF)

                   12416      10967      11496      11265      12126


         *****      BTU RE      BTU RE       BTU RE     BTU RE
                    -----PRODUCT-----        -----UPG COAL-----
                                (ADJ)                   (ADJ)
                    103.33      105.46       88.37      90.19




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.40      9.09

 11.67      1.19    10967
```

```
                         DATA  CHECKING

                            R1-M-7A


                  *        YIELD%    YIELD%
                         (PRODUCT)  (UPG COAL)

                           94.10       87.35


                 **        RES%       RES%
                          (DETN)   (CAL FROM S)

                            7.17       12.89

                ***     ASH%     ASH%     ASH%
                       (DETN)   (CAL)   (CAL-UC)

                        13.21   10.84    11.68


        ****       BTU        BTU        BTU        BTU        BTU
                  (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                  (MAF)                            (ADJ)       (MAF)

                  12527      10872      11305      11005      12163


        *****      BTU RE     BTU RE      BTU RE     BTU RE
                   -----PRODUCT-----      -----UPG COAL-----
                               (ADJ)                 (ADJ)
                   101.58     104.36      89.88      92.33



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.10      7.17

 13.21      1.18    10872
```

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                   [illegible]TA CHECKING

                              R2-M-8A


                  *          YIELD%     YIELD%
                           (PRODUCT)  (UPG COAL)

                             91.40       84.30


                 **          RES%       RES%
                            (DETN)   (CAL FROM S)

                              7.77       11.38

                ***     ASH%     ASH%      ASH%
                       (DETN)   (CAL)    (CAL-UC)

                       10.37    10.28     11.15


         ****       BTU        BTU        BTU         BTU        BTU
                   (DETN)     (DETN)     (CAL)       (CAL)      (COAL)
                   (MAF)                             (ADJ)       (MAF)

                   12386      11102      11410       11399      12126


         *****      BTU RE     BTU RE      BTU RE     BTU RE
                   -----PRODUCT-----       -----UPG COAL-----
                              (ADJ)                   (ADJ)
                   100.22     100.32       87.96      88.05


(UPG COAL)---THE C[illegible] PORTION OF THE PRODUCT
(DETN)---FROM ACTU[illegible] DETERMINATION
(CAL FROM S)---CA[illegible]ATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 91.40     7.77

 10.37     1.13    11102
```

```
                    DATA  CHECKING

                         C1-M-9A


                 *         YIELD%    YIELD%
                        (PRODUCT)   (UPG COAL)

                           95.60       89.11


                **         RES%       RES%
                           (DETN)   (CAL FROM S)

                            6.79        6.08

               ***      ASH%     ASH%     ASH%
                       (DETN)   (CAL)    (CAL-UC)

                        10.46    11.19    12.01


        ****        BTU         BTU        BTU        BTU        BTU
                   (DETN)      (DETN)     (CAL)      (CAL)      (COAL)
                   (MAF)                             (ADJ)       (MAF)

                   13711       12277      12505      12609      13690


        *****      BTU RE      BTU RE      BTU RE      BTU RE
                   -----PRODUCT-----       -----UPG COAL-----
                               (ADJ)                   (ADJ)
                   102.06      101.22       92.20       91.44



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.60     6.79

 10.46     0.60    12277
```

```
                      DATA  CHECKING

                            C2-M-10A

              *         YIELD%    YIELD%
                      (PRODUCT)  (UPG COAL)

                        96.70      88.56

             **         RES%      RES%
                        (DETN)  (CAL FROM S)

                         8.42       8.86

            ***      ASH%     ASH%     ASH%
                    (DETN)   (CAL)    (CAL-UC)

                     11.17    11.07    12.08

    ****        BTU        BTU        BTU        BTU        BTU
               (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
               (MAF)                            (ADJ)       (MAF)

               13753      12217      12568      12553      13659

    *****      BTU RE     BTU RE       BTU RE     BTU RE
               -----PRODUCT-----       -----UPG COAL-----
                          (ADJ)                   (ADJ)
               102.85     102.97        90.46      90.57

(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY
```

```
                    DATA CHECKING

                       C1-M-11A

                *       YIELD%     YIELD%
                      (PRODUCT)  (UPG COAL)

                        95.40      87.24


               **       RES%        RES%
                       (DETN)   (CAL FROM S)

                        8.55        6.77

              ***    ASH%     ASH%     ASH%
                    (DETN)   (CAL)    (CAL-UC)

                     10.56    11.22    12.26


       ****       BTU        BTU        BTU        BTU        BTU
                 (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                 (MAF)                            (ADJ)      (MAF)

                 13652      12210      12599      12692      13690


       *****      BTU RE     BTU RE      BTU RE     BTU RE
                 -----PRODUCT-----      -----UPG COAL-----
                             (ADJ)                  (ADJ)
                 101.29     100.55       88.90      88.24



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.40     8.55

 10.56     0.63    12210
```

```
                          DATA CHECKING

                             C2-M-12A


                  *        YIELD%     YIELD%
                         (PRODUCT)  (UPG COAL)

                           94.50      86.81


                 **        RES%       RES%
                           (DETN)   (CAL FROM S)

                            8.14        9.32

                ***     ASH%     ASH%     ASH%
                       (DETN)   (CAL)    (CAL-UC)

                       10.81    11.32    12.33


      ****       BTU        BTU        BTU        BTU        BTU
                (DETN)     (DETN)     (CAL)      (CAL)     (COAL)
                (MAF)                            (ADJ)      (MAF)

                13621      12149      12553      12626      13659



      *****      BTU RE     BTU RE      BTU RE     BTU RE
                 -----PRODUCT-----      -----UPG COAL-----
                            (ADJ)                  (ADJ)
                  99.95      99.37       98.25      87.74




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.50     8.14

 10.81     0.73    12149
```

```
                         DATA CHECKING
                            T1-E-1A

              *         YIELD%    YIELD%
                      (PRODUCT)  (UPG COAL)

                         97.00      89.93

             **          RES%      RES%
                        (DETN)  (CAL FROM S)

                          7.39    (SULFUR NOT ANALYZED)

            ***      ASH%    ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                    35.22   32.78   35.40

     ****        BTU       BTU       BTU       BTU       BTU
                (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
                (MAF)                         (ADJ)      (MAF)

                12654      8197      8159      8827     12740

     *****      BTU RE     BTU RE       BTU RE     BTU RE
                ------PRODUCT-----      -----UPG COAL-----
                           (ADJ)                   (ADJ)
                 99.07    102.79        83.13      86.26

(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY

 97.00     7.39
 35.22     0.00     8197
```

DATA CHECKING

```
                          T2-E-2A


             *        YIELD%     YIELD%
                    (PRODUCT)  (UPG COAL)

                      96.60       89.96


            **        RES%        RES%
                      (DETN)   (CAL FROM S)

                       6.87     (SULFUR NOT ANALYZED)


           ***     ASH%     ASH%     ASH%
                  (DETN)   (CAL)    (CAL-UC)

                   36.32    32.71    35.13


    ****          BTU        BTU        BTU        BTU        BTU
                 (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                 (MAF)                            (ADJ)      (MAF)

                 12352       7866       9226       8731      12879


    *****        BTU RE      BTU RE       BTU RE      BTU RE
                 -----PRODUCT-----        -----UPG COAL-----
                             (ADJ)                    (ADJ)
                  93.21       98.49        78.69       83.14




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.60     6.87

 36.32     0.00    7866
```

```
                 DATA CHECKING

                      T1-E-3A


             *         YIELD%    YIELD%
                     (PRODUCT)  (UPG COAL)

                        94.50       98.42


            **          RES%       RES%
                       (DETN)   (CAL FROM S)

                        6.43      (SULFUR NOT ANALYZED)


           ***      ASH%      ASH%      ASH%
                   (DETN)    (CAL)    (CAL-UC)

                    29.21     33.65     35.96


    ****       BTU          BTU          BTU          BTU          BTU
              (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
              (MAF)                                  (ADJ)        (MAF)

              13135         9298         9069         9676        12740


    *****      BTU RE       BTU RE        BTU RE       BTU RE
               ------PRODUCT-----         ------UPG COAL-----
                            (ADJ)                      (ADJ)
               109.48       102.61         95.97        99.95



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.50      6.43

 29.21      0.00    9298
```

DATA CHECKING

```
                         T2-E-4A


          *          YIELD%     YIELD%
                   (PRODUCT)  (UPG COAL)

                     94.60       97.42


        **           RES%        RES%
                    (DETN)   (CAL FROM S)

                      7.59     (SULFUR NOT ANALYZED)


       ***       ASH%     ASH%     ASH%
                (DETN)   (CAL)    (CAL-UC)

                 31.50    33.40    36.15


****          BTU           BTU          BTU          BTU          BTU
             (DETN)        (DETN)       (CAL)        (CAL)        (COAL)
             (MAF)                                   (ADJ)         (MAF)

             12930          8857         9292         9558        12978


*****         BTU RE      BTU RE         BTU RE      BTU RE
              -----PRODUCT-----          -----UPG COAL-----
                          (ADJ)                      (ADJ)
              102.78      99.92          97.07       94.65



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.60      7.59

 31.50      0.00     8857
```

DATA CHECKING

```
                       R1-E-5A


          *        YIELD%    YIELD%
                 (PRODUCT)  (UPG COAL)

                   92.80       85.59


         **         RES%       RES%
                   (DETN)   (CAL FROM S)

                    7.77     (SULFUR NOT ANALYZED)


        ***      ASH%     ASH%      ASH%
               (DETN)   (CAL)    (CAL-UC)

                15.71    10.99    11.92

 ****        BTU        BTU        BTU        BTU        BTU
            (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
            (MAF)                            (ADJ)       (MAF)

            12183      10269      11374      10771      12163


 *****      BTU RE      BTU RE      BTU RE      BTU RE
            -----PRODUCT-----       -----UPG COAL-----
                        (ADJ)                   (ADJ)
             94.62       99.92       81.85       86.43



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 92.80     7.77

 15.71     0.00    10269
```

```
                 DATA  CHECKING

                      R2-E-6A


             *        YIELD%    YIELD%
                    (PRODUCT)  (UPG COAL)

                      94.70       86.65


            **        RES%       RES%
                     (DETN)   (CAL FROM S)

                       8.50     (SULFUR NOT ANALYZED)


           ***      ASH%     ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                    12.59    9.93    10.85


 ****        BTU         BTU         BTU         BTU         BTU
            (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
            (MAF)                               (ADJ)        (MAF)

            12158       10627       11489       11149       12126


 *****      BTU RE     BTU RE        BTU RE     BTU RE
            -----PRODUCT-----        -----UPG COAL-----
                        (ADJ)                     (ADJ)
             99.40     102.42         85.21       87.91



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 94.70      8.50

 12.59      0.00    10627
```

DATA CHECKING

```
                              R1-E-7A


              *        YIELD%    YIELD%
                     (PRODUCT)  (UPG COAL)

                        92.90      95.93


             **        RES%      RES%
                       (DETN)  (CAL FROM S)

                        7.50    (SULFUR NOT ANALYZED)


            ***     ASH%     ASH%     ASH%
                   (DETN)   (CAL)   (CAL-UC)

                   13.98    10.98    11.87


   ****       BTU         BTU         BTU         BTU         BTU
             (DETN)      (DETN)      (CAL)       (CAL)       (COAL)
             (MAF)                               (ADJ)        (MAF)

             12351       10624       11355       10972       12163


   *****      BTU RE      BTU RE       BTU RE      BTU RE
              -----PRODUCT-----        -----UPG COAL-----
                          (ADJ)                    (ADJ)
               99.00      101.42        95.66       89.65



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 92.90      7.50

 13.98      0.00     10624
```

```
                    DATA  CHECKING

                                R2-E-8A


                     *          YIELD%    YIELD%
                              (PRODUCT)  (UPG COAL)

                                 93.30      85.57


                    **          RES%       RES%
                                (DETN)   (CAL FROM S)

                                 8.29     (SULFUR NOT ANALYZED)


                   ***       ASH%     ASH%      ASH%
                            (DETN)   (CAL)    (CAL-UC)

                             10.40    10.08    10.99


           ****         BTU          BTU          BTU          BTU          BTU
                       (DETN)       (DETN)       (CAL)        (CAL)        (COAL)
                       (MAF)                                  (ADJ)         (MAF)

                       12304        11024        11474        11433        12126


           *****        BTU RE       BTU RE         BTU RE      BTU RE
                        -----PRODUCT-----           -----UPG COAL-----
                                     (ADJ)                      (ADJ)
                        101.58       101.95          87.95       88.27



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 93.30     8.29

 10.40     0.00    11024
```

```
                      DATA  CHECKING

                          C1-E-9A


                   *        YIELD%    YIELD%
                          (PRODUCT)  (UPG COAL)

                            95.90      89.60


                  **        RES%       RES%
                           (DETN)   (CAL FROM S)

                            6.57     (SULFUR NOT ANALYZED)


                 ***      ASH%     ASH%      ASH%
                         (DETN)   (CAL)    (CAL-UC)

                           9.40    11.16    11.94


          ****      BTU        BTU        BTU        BTU        BTU
                   (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                   (MAF)                            (ADJ)       (MAF)

                   13480      12213      12518      12766      13690


          *****     BTU RE      BTU RE       BTU RE      BTU RE
                    -----PRODUCT-----        -----UPG COAL-----
                                (ADJ)                    (ADJ)
                    101.85      99.87        92.07       90.28



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.90     6.57

  9.40     0.00   12213
```

```
                    DATA CHECKING

                         C2-E-10A


                 *         YIELD%     YIELD%
                         (PRODUCT)  (UPG COAL)

                           96.40       89.84


                **         RES%       RES%
                           (DETN)   (CAL FROM S)

                            6.80     (SULFUR NOT ANALYZED)


               ***      ASH%     ASH%     ASH%
                      (DETN)   (CAL)    (CAL-UC)

                       11.82    11.10    11.91


        ****        BTU        BTU        BTU        BTU        BTU
                   (DETN)     (DETN)     (CAL)      (CAL)      (COAL)
                   (MAF)                            (ADJ)       (MAF)

                   13462      11871      12506      12405      13659


        *****      BTU RE     BTU RE       BTU RE     BTU RE
                   -----PRODUCT-----       -----UPG COAL-----
                              (ADJ)                   (ADJ)
                    99.62     100.44        89.44      90.17



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 96.40     6.80

 11.82     0.00    11871
```

DATA CHECKING

```
                              C1-E-11A


                  *        YIELD%    YIELD%
                         (PRODUCT)  (UPG COAL)

                            95.80      89.66


                 **         RES%       RES%
                           (DETN)   (CAL FROM S)

                            6.41     (SULFUR NOT ANALYZED)


                ***      ASH%     ASH%     ASH%
                        (DETN)   (CAL)    (CAL-UC)

                         10.60   11.17    11.93


     ****         BTU       BTU       BTU       BTU       BTU
                 (DETN)    (DETN)    (CAL)     (CAL)     (COAL)
                 (MAF)                         (ADJ)      (MAF)

                 13482     12053     12509     12589     13690


     *****        BTU RE      BTU RE       BTU RE      BTU RE
                 -----PRODUCT-----        -----UPG COAL-----
                              (ADJ)                    (ADJ)
                 100.41       99.77        90.88       90.30



(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.80      6.41

 10.60      0.00     12053
```

```
                         DATA  CHECKING

                                C2-E-12A


                         *         YIELD%     YIELD%
                                 (PRODUCT)   (UPG COAL)

                                   95.50        39.06


                        **         RES%        RES%
                                   (DETN)    (CAL FROM S)

                                    6.74     (SULFUR NOT ANALYZED)


                       ***      ASH%     ASH%      ASH%
                              (DETN)   (CAL )    (CAL-UC)

                               11.02    11.20     12.01


          ****         BTU         BTU         BTU         BTU          BTU
                      (DETN)      (DETN)      (CAL)       (CAL)        (COAL)
                      (MAF)                               (ADJ)         (MAF)

                      13455       11972       12503       12529        13659


          *****       BTU RE      BTU RE          BTU RE      BTU RE
                      -----PRODUCT-----           -----UPG COAL-----
                                   (ADJ)                      (ADJ)
                       99.53       99.33           39.53       39.35




(UPG COAL)---THE COAL PORTION OF THE PRODUCT
(DETN)---FROM ACTUAL DETERMINATION
(CAL FROM S)---CALCULATED VALUE FORM SULFUR BALANCE
(CAL-UC)---CALCULATED VALUE FOR UPGRADED COAL
(MAF)---MOISTURE ASH FREE BASIS
(ADJ)---ADJUSTMENT OF ASH% FROM DETERMINED VALUE TO THEORECTICAL VALUE
BTU RE---BTU RECOVERY


 95.50     6.74

 11.02     0.00    11972
```

MASS BALANCE

WD-3 (S2,T1,L3)

PRODUCT YIELD %	WATER YIELD [illegible]	GAS [illegible]	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
91.70	11.5[illegible]	[illegible]	7.64	7.01	84.69

WT IN = 107.01

WT OUT= 103.84

MASS RECOVERY % = 97.04

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
8273	17316	10535	32000	116.77	102.11

TOTAL BTU IN =527008

TOTAL BTU OUT=550455

BTU RECOVERY %=104.45

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
109.61	95.85

COMPOSITIONAL BALANCE

	WEIGHT OF CARBON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	49.36	2.93	0.58	15.32	0.30	19.37	12.14
RESIDUUM	5.92	0.57	0.07	0.01	0.44	0.00	0.00
TOTAL IN	55.28	3.50	0.65	15.33	0.74	19.37	12.14
PRODUCTS							
PRODUCT	54.32	3.77	0.45	12.15	0.71	19.37	0.94
WATER	0.00	0.00	0.00	0.00	0.00	0.00	11.50
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	54.32	3.77	0.45	12.15	0.71	19.37	12.44
TOTAL OUT/IN	0.98	1.08	0.69	0.79	0.96	1.00	1.02
UPGRADED COAL PERCENT	57.15	3.78	0.44	14.33	0.32	22.87	1.11

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

MASS BALANCE

```
                              WD-7 (S1,T1,L3)

PRODUCT   WATER      GAS    RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD [illegible] YIELD %   PRODUCT %      FEED COAL %      UPGRADED COAL

 87.80    11.40     0.64       4.33            3.80             84.00

WT IN = 103.80

WT OUT=  99.84

MASS RECOVERY % =  96.18
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF   BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM     PRODUCT      GAS        PRODUCT      UPGRADED COAL
  8463       17316        9887      32000       102.57           94.79

TOTAL BTU IN =506739

TOTAL BTU OUT=496021

BTU RECOVERY %= 97.88

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING AR

                   (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                       104.77                 96.82
```

COMPOSITIONAL BALANCE

```
                                   WEIGHT OF
                CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR   ASH    WATER
FEED
 COAL            51.51     2.89      0.66    13.93    0.30   18.48   12.23
 RESIDUUM         3.21     0.31      0.04     0.01    0.24    0.00    0.00
 TOTAL IN        54.72     3.20      0.70    13.94    0.54   18.48   12.23
PRODUCTS
 PRODUCT         49.31     3.17      0.55    14.56    0.61   18.48    1.12
 WATER            0.00     0.00      0.00     0.00    0.00    0.00   11.40
 GAS              0.00     0.00      0.00     0.00    0.00    0.00    0.00
 TOTAL OUT       49.31     3.17      0.55    14.56    0.61   18.48   12.52
 TOTAL OUT/IN     0.90     0.99      0.78     1.04    1.14    1.00    1.02
 UPGRADED COAL   54.88     3.40      0.60    17.33    0.44   22.00    1.33
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

```
                                   WD-8 (S3,T1,L3)

PRODUCT   WATER        GAS       RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %   YIELD[illegible] %    PRODUCT %       FEED COAL %     UPGRADED COAL

  95.20    11.6[illegible]   0.64      10.25            9.76              85.44

WT IN = 109.76

WT OUT= 107.44

MASS RECOVERY % =  97.89
```

BTU RECOVERIES

```
BTU/IB OF   BTU/IB OF   BTU/IB OF   BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL      RESIDUUM     PRODUCT       GAS        PRODUCT      UPGRADED COAL
   7939       17316        9768       32000       117.13            95.85

TOTAL BTU IN =534928

TOTAL BTU OUT=530374

BTU RECOVERY %= 99.15

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                      (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                           119.64                 97.90
```

COMPOSITIONAL BALANCE

```
                                     WEIGHT OF
                     CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL                 46.30     2.29      0.50   16.93    0.32   21.99   11.67
 RESIDUUM              8.24     0.79      0.10    0.02    0.61    0.00    0.00
 TOTAL IN             54.54     3.08      0.60   16.95    0.93   21.99   11.67
PRODUCTS
 PRODUCT              53.62     3.67      0.55   13.48    0.95   21.99    0.94
 WATER                 0.00     0.00      0.00    0.00    0.00    0.00   11.60
 GAS                   0.00     0.00      0.00    0.00    0.00    0.00    0.00
 TOTAL OUT            53.62     3.67      0.55   13.48    0.95   21.99   12.54
 TOTAL OUT/IN          0.98     1.19      0.92    0.80    1.03    1.00    1.07
 UPGRADED COAL        53.11     3.37      0.53   15.75    0.40   25.74    1.10
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

```
                         MASS BALANCE

                       WD-11 (S3,T2,L1)

PRODUCT   WATE[redacted]  RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %   YIEL            PRODUCT %    FEED COAL %       UPGRADED COAL

 95.70    10.             10.12            9.68              86.02

WT IN = 109.68

WT OUT= 107.24

MASS RECOVERY % =  97.77



                        BTU RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
   7939      17316      10036      32000        120.98            99.85

TOTAL BTU IN =534224

TOTAL BTU OUT=547336

BTU RECOVERY %=102.45

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING AR

             (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                 124.04                 102.38



                  COMPOSITIONAL BALANCE

                              WEIGHT OF
                 CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR   ASH   WATER
FEED
 COAL            46.30     2.29      0.50    16.93    0.32   21.99  11.67
 RESIDUUM         8.18     0.78      0.10     0.02    0.60    0.00   0.00
 TOTAL IN        54.48     3.07      0.60    16.95    0.92   21.99  11.67
PRODUCTS
 PRODUCT         55.79     3.70      0.58    11.99    0.95   21.99   0.70
 WATER            0.00     0.00      0.00     0.00    0.00    0.00  10.90
 GAS              0.00     0.00      0.00     0.00    0.00    0.00   0.00
 TOTAL OUT       55.79     3.70      0.58    11.99    0.95   21.99  11.60
 TOTAL OUT/IN     1.02     1.20      0.96     0.71    1.03    1.00   0.99
 UPGRADED COAL   55.35     3.39      0.56    13.92    0.40   25.57   0.81
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

```
                          MASS  BALANCE

                         WD-13 (S1,T2,L1)

PRODUCT   WATER      GAS    RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %  YIELD %    PRODUCT %       FEED COAL %     UPGRADED COAL

  92.50   11.8[illegible]     0.64       6.86             6.35                86.15

WT IN = 106.35

WT OUT= 104.94

MASS RECOVERY % =  98.68


                          BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT     UPGRADED COAL
  8463      17316       9847       32000       107.63           94.64

TOTAL BTU IN =531210

TOTAL BTU OUT=519781

BTU RECOVERY %= 97.85

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                 (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                      108.58                95.48


                    COMPOSITIONAL  BALANCE

                                WEIGHT OF
                CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR   ASH   WATER
FEED
 COAL            51.51     2.89      0.66   13.93    0.30  18.48   12.23
 RESIDUUM         5.36     0.51      0.07    0.01    0.40   0.00    0.00
 TOTAL IN        56.87     3.40      0.73   13.94    0.70  18.48   12.23
PRODUCTS
 PRODUCT         56.96     3.56      0.59   11.32    0.61  18.48    0.99
 WATER            0.00     0.00      0.00    0.00    0.00   0.00   11.80
 GAS              0.00     0.00      0.00    0.00    0.00   0.00    0.00
 TOTAL OUT       56.96     3.56      0.59   11.32    0.61  18.48   12.79
 TOTAL OUT/IN     1.00     1.04      0.81    0.81    0.87   1.00    1.05
 UPGRADED COAL   59.89     3.53      0.61   13.13    0.24  21.45    1.15
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

```
                          MASS BALANCE

                         WD-17 (S2,T2,L1)

  PRODUCT   WATER      GAS   RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
  YIELD %   YIEL[illegible]LD %   PRODUCT %      FEED COAL %     UPGRADED COAL

   92.50    12.7[illegible] 0.64       5.95           5.50             87.00

  WT IN = 105.50

  WT OUT= 105.84

  MASS RECOVERY % = 100.32


                         BTU RECOVERIES

 BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
   COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
   8273       17316      10004      32000       111.85           100.33

 TOTAL BTU IN =512557

 TOTAL BTU OUT=527849

 BTU RECOVERY %=102.98

 *NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING AR[illegible]:

                (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                   112.08                 100.54


                     COMPOSITIONAL BALANCE

                           WEIGHT OF
                CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR   ASH   WATER
FEED
 COAL            49.36     2.93      0.58    15.32    0.30  19.37  12.14
 RESIDUUM         4.65     0.44      0.06     0.01    0.34   0.00   0.00
 TOTAL IN        54.01     3.37      0.64    15.33    0.64  19.37  12.14
PRODUCTS
 PRODUCT         55.58     2.90      0.57    12.30    0.58  19.37   1.20
 WATER            0.00     0.00      0.00     0.00    0.00   0.00  12.70
 GAS              0.00     0.00      0.00     0.00    0.00   0.00   0.00
 TOTAL OUT       55.58     2.90      0.57    12.30    0.58  19.37  13.90
 TOTAL OUT/IN     1.03     0.86      0.89     0.80    0.91   1.00   1.15
 UPGRADED COAL   58.54     2.82      0.58    14.13    0.28  22.27   1.39
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

WD-26 (S1,T3,L2)

PRODUCT YIELD %	WATER YIELD [illegible]	GAS [illegible] %	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
91.90	12.10	0.64	7.49	6.88	85.02

WT IN = 106.88

WT OUT= 104.64

MASS RECOVERY % = 97.90

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
8463	17316	8898	32000	96.62	82.54

TOTAL BTU IN =536384

TOTAL BTU OUT=468047

BTU RECOVERY %= 87.26

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
107.95	92.21

COMPOSITIONAL BALANCE

WEIGHT OF

	CARBON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	51.51	2.89	0.66	13.93	0.30	18.48	12.23
RESIDUUM	5.81	0.56	0.07	0.01	0.43	0.00	0.00
TOTAL IN	57.32	3.45	0.73	13.94	0.73	18.48	12.23
PRODUCTS							
PRODUCT	54.35	3.69	0.60	13.11	0.79	18.48	0.88
WATER	0.00	0.00	0.00	0.00	0.00	0.00	12.10
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	54.35	3.69	0.60	13.11	0.79	18.48	12.98
TOTAL OUT/IN	0.95	1.07	0.81	0.94	1.08	1.00	1.06
UPGRADED COAL PERCENT	57.09	3.68	0.62	15.41	0.42	21.74	1.04

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

MASS BALANCE

WD-27 (S2,T3,L1)

PRODUCT YIELD %	WATER YIEL[illegible]	GA[illegible]	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
91.70	11.[illegible]	[illegible]	5.57	5.11	86.59

WT IN = 105.11

WT OUT= 104.14

MASS RECOVERY % = 99.08

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
8273	17316	9955	32000	110.34	99.65

TOTAL BTU IN =508747

TOTAL BTU OUT=520907

BTU RECOVERY %=102.39

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING AR

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
112.65	101.74

COMPOSITIONAL BALANCE

	WEIGHT OF [illegible]BON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	49.36	2.93	0.58	15.32	0.30	19.37	12.14
RESIDUUM	4.31	0.41	0.05	0.01	0.32	0.00	0.00
TOTAL IN	53.67	3.34	0.63	15.33	0.62	19.37	12.14
PRODUCTS							
PRODUCT	52.66	3.25	0.61	14.31	0.71	19.37	0.79
WATER	0.00	0.00	0.00	0.00	0.00	0.00	11.80
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	52.66	3.25	0.61	14.31	0.71	19.37	12.59
TOTAL OUT/IN	0.98	0.97	0.96	0.93	1.15	1.00	1.04
UPGRADED COAL PERCENT	55.83	3.27	0.64	16.52	0.45	22.37	0.91

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

MASS BALANCE

WM-2 (S2,T1,L2)

PRODUCT YIELD %	WATER YIELD %	GAS YIELD %	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
91.70	11.50	0.64	6.38	5.85	85.85

WT IN = 105.85

WT OUT= 103.84

MASS RECOVERY % = 98.10

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
8273	17473	9674	32000	107.23	94.87

TOTAL BTU IN =516403

TOTAL BTU OUT=506591

BTU RECOVERY %= 98.10

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
111.27	98.45

COMPOSITIONAL BALANCE

	WEIGHT OF CARBON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	49.36	2.93	0.58	15.32	0.30	19.37	12.14
RESIDUUM	4.97	0.55	0.05	0.01	0.27	0.00	0.00
TOTAL IN	54.33	3.48	0.63	15.33	0.57	19.37	12.14
PRODUCTS							
PRODUCT	52.38	3.58	0.69	13.65	0.56	19.37	1.47
WATER	0.00	0.00	0.00	0.00	0.00	0.00	11.50
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	52.38	3.59	0.69	13.65	0.56	19.37	12.97
TOTAL OUT/IN	0.96	1.03	1.11	0.89	0.98	1.00	1.07
UPGRADED COAL PERCENT	55.22	3.52	0.75	15.89	0.34	22.56	1.73

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

MASS BALANCE

```
                                   WM-4 (S1.T1,L2)

PRODUCT   WATER     GAS    RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %  YIELD %   PRODUCT %      FEED COAL %     UPGRADED COAL

 89.40    11.40    0.64       2.89            2.58             86.82

WT IN = 102.58

WT OUT= 101.44

MASS RECOVERY % =  98.89
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
   9463      17473       9862      32000       104.18           98.84

TOTAL BTU IN =495247

TOTAL BTU OUT=503568

BTU RECOVERY %=101.68

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING AR

                   (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                       106.60                 101.14
```

COMPOSITIONAL BALANCE

```
                                  WEIGHT OF
                    CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR   ASH   WATER
FEED
 COAL                51.51     2.89      0.66    13.93    0.30  18.48  12.23
 RESIDUUM             2.20     0.24      0.02     0.00    0.12   0.00   0.00
 TOTAL IN            53.71     3.13      0.68    13.93    0.42  18.48  12.23
PRODUCTS
 PRODUCT             52.48     3.41      0.68    12.30    0.50  18.48   1.55
 WATER                0.00     0.00      0.00     0.00    0.00   0.00  11.40
 GAS                  0.00     0.00      0.00     0.00    0.00   0.00   0.00
 TOTAL OUT           52.48     3.41      0.68    12.30    0.50  18.48  12.95
 TOTAL OUT/IN         0.98     1.09      0.99     0.88    1.20   1.00   1.06
 UPGRADED COAL       57.92     3.65      0.76    14.17    0.44  21.29   1.79
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                         MASS  BALANCE

                        WM-7 (S3,T1,L2)

PRODUCT   WATER    GAS     RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %  YIELD %   PRODUCT %      FEED COAL %     UPGRADED COAL

 90.20    11.90     0.64     10.60            9.56              80.64

WT IN = 109.56

WT OUT= 102.74

MASS RECOVERY % =  93.77


                       BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
   7939      17473       9915     32000        112.65           91.61

TOTAL BTU IN =533868

TOTAL BTU OUT=510607

BTU RECOVERY %= 95.64

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL

                     110.59                 89.93


                 COMPOSITIONAL  BALANCE

                                WEIGHT OF
                 CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR   ASH   WATER
FEED
 COAL             46.30    2.29      0.50    16.93    0.32   21.99  11.67
 RESIDUUM          8.12    0.91      0.08     0.01    0.44    0.00   0.00
 TOTAL IN         54.42    3.20      0.58    16.94    0.76   21.99  11.67
PRODUCTS
 PRODUCT          50.34    3.52      0.60    11.49    0.86   21.99   1.40
 WATER             0.00    0.00      0.00     0.00    0.00    0.00  11.90
 GAS               0.00    0.00      0.00     0.00    0.00    0.00   0.00
 TOTAL OUT        50.34    3.52      0.60    11.49    0.86   21.99  13.30
 TOTAL OUT/IN      0.92    1.10      1.04     0.68    1.12    1.00   1.14
 UPGRADED COAL    52.35    3.24      0.65    14.24    0.51   27.27   1.74
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                          MASS  BALANCE

                         WM-10 (S2,T2,L2)

PRODUCT   WATER      GAS      RESIDUUM ON  RESIDUUM USED FOR    YIELD % OF
YIELD %  YIELD [illegible]D %   PRODUCT %      FEED COAL %      UPGRADED COAL

 89.00     11.20    0.64       3.94            3.51              85.49

WT IN = 103.51

WT OUT= 100.84

MASS RECOVERY % =  97.42



                         BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS         PRODUCT      UPGRADED COAL
   9273      17473       8702      32000         93.62           86.21

TOTAL BTU IN =493650

TOTAL BTU OUT=444020


BTU RECOVERY %= 99.95

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING AR

                  (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                       103.52               95.33



                    COMPOSITIONAL  BALANCE

                             WEIGHT OF
               CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL          49.36     2.93      0.58    15.32    0.30   19.37   12.14
 RESIDUUM       2.98     0.33      0.03     0.00    0.16    0.00    0.00
 TOTAL IN      52.34     3.26      0.61    15.32    0.46   19.37   12.14
PRODUCTS
 PRODUCT       50.88     3.51      0.59    13.03    0.56   19.37    1.05
 WATER          0.00     0.00      0.00     0.00    0.00    0.00   11.20
 GAS            0.00     0.00      0.00     0.00    0.00    0.00    0.00
 TOTAL OUT     50.88     3.51      0.59    13.03    0.56   19.37   12.25
 TOTAL OUT/IN   0.97     1.08      0.97     0.85    1.21    1.00    1.01
 UPGRADED COAL 56.03     3.72      0.66    15.24    0.47   22.66    1.23
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

```
                              WM-14 (S3,T2,L2)

PRODUCT   [redacted]   RESIDUUM ON   RESIDUUM USED FOR   YIELD % OF
YIELD %                PRODUCT %       FEED COAL %     UPGRADED COAL

 97.90    [redacted]     10.40            10.18              87.72

WT IN = 110.18

WT OUT= 110.14

MASS RECOVERY % =  99.96
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
  7939       17473       9683      32000       119.41           97.00

TOTAL BTU IN =539891

TOTAL BTU OUT=540403

BTU RECOVERY %=100.09

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                 (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                      122.10                  99.18
```

COMPOSITIONAL BALANCE

```
                                     WEIGHT OF
                 CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH    WATER
FEED
 COAL             46.30     2.29      0.50    16.93    0.32   21.99   11.67
 RESIDUUM          8.65     0.97      0.08     0.01    0.47    0.00    0.00
 TOTAL IN         54.95     3.26      0.58    16.94    0.79   21.99   11.67
PRODUCTS
 PRODUCT          54.96     3.98      0.68    13.70    1.04   21.99    1.54
 WATER             0.00     0.00      0.00     0.00    0.00    0.00   11.60
 GAS               0.00     0.00      0.00     0.00    0.00    0.00    0.00
 TOTAL OUT        54.96     3.98      0.68    13.70    1.04   21.99   13.14
 TOTAL OUT/IN      1.00     1.22      1.17     0.81    1.31    1.00    1.13
 UPGRADED COAL    52.79     3.44      0.68    15.61    0.65   25.07    1.76
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                              MASS BALANCE

                           WM-15 (S1,T2,L2)

PRODUCT    WATER       GAS     RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD [illegible] YIELD%  PRODUCT %    FEED COAL %     UPGRADED COAL

 90.50    12.00       0.64        5.49           4.97              85.53

WT IN = 104.97

WT OUT= 103.14

MASS RECOVERY % =  98.26


                           BTU RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS         PRODUCT      UPGRADED COAL
   9463      17473        9889     32000        105.75           95.49

TOTAL BTU IN =519397

TOTAL BTU OUT=510952


BTU RECOVERY %= 98.56


*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

                  (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                      107.30                  96.89


                      COMPOSITIONAL BALANCE

                                WEIGHT OF
                  CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL              51.51     2.89      0.66   13.93    0.30   18.48   12.23
 RESIDUUM           4.22     0.47      0.04    0.00    0.23    0.00    0.00
 TOTAL IN          55.73     3.36      0.70   13.93    0.53   18.48   12.23
PRODUCTS
 PRODUCT           53.34     3.42      0.67   13.23    0.51   18.48    0.85
 WATER              0.00     0.00      0.00    0.00    0.00    0.00   12.00
 GAS                0.00     0.00      0.00    0.00    0.00    0.00    0.00
 TOTAL OUT         53.34     3.42      0.67   13.23    0.51   18.48   12.85
 TOTAL OUT/IN       0.96     1.02      0.96    0.95    0.95    1.00    1.05
 UPGRADED COAL     57.43     3.44      0.74   15.47    0.32   21.61    1.00
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                          MASS BALANCE

                         WM-22 (S3,T3,L2)

PRODUCT    WATER       GAS     RESIDUUM ON   RESIDUUM USED FOR    YIELD % OF
YIELD %   YIELD [illegible] YIELD %   PRODUCT %       FEED COAL %     UPGRADED COAL

  92.00     11.00      0.64     13.40           12.33               79.67

WT IN = 112.33

WT OUT= 103.64

MASS RECOVERY % =  92.27



                         BTU RECOVERIES

BTU/IB OF   BTU/IB OF   BTU/IB OF   BTU/IB OF   % BTU RECOVERY   % BTU RECOVERY
  COAL      RESIDUUM    PRODUCT       GAS          PRODUCT       UPGRADED COAL
   7939       17473        9859       32000         114.25             97.12

TOTAL BTU IN =560726

TOTAL BTU OUT=517659

BTU RECOVERY %= 92.32

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                   (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                       115.94                 98.40



                    COMPOSITIONAL BALANCE

                                 WEIGHT OF
                CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL            46.30      3.29      0.50   16.93    0.32  21.99   11.67
 RESIDUUM        10.47      1.17      0.10    0.01    0.57   0.00    0.00
 TOTAL IN        56.77      3.46      0.60   16.94    0.89  21.99   11.67
PRODUCTS
 PRODUCT         53.05      3.84      0.63   10.54    0.92  21.99    1.03
 WATER            0.00      0.00      0.00    0.00    0.00   0.00   11.00
 GAS              0.00      0.00      0.00    0.00    0.00   0.00    0.00
 TOTAL OUT       53.05      3.84      0.63   10.54    0.92  21.99   12.03
 TOTAL OUT/IN     0.93      1.11      1.06    0.62    1.03   1.00    1.03
 UPGRADED COAL   53.44      3.35      0.67   13.22    0.44  27.60    1.28
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

```
                              WM-25 (S2,T3,L2)

PRODUCT   WATER             GAS      RESIDUUM ON   RESIDUUM USED FOR    YIELD % OF
YIELD %   YIELD [illegible] YIELD %  PRODUCT %        FEED COAL %       UPGRADED COAL

 89.30    12.1[illegible]   0.64       9.15              7.28               82.02

WT IN = 107.28

WT OUT= 102.04

MASS RECOVERY % =  95.12
```

BTU RECOVERIES

```
BTU/IB OF   BTU/IB OF   BTU/IB OF   BTU/IB OF   % BTU RECOVERY   % BTU RECOVERY
  COAL      RESIDUUM     PRODUCT       GAS          PRODUCT       UPGRADED COAL
  9273        17473        9984       32000         107.77             92.40

TOTAL BTU IN =530260

TOTAL BTU OUT=509072

BTU RECOVERY %= 96.00

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

                (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                    107.52                   92.18
```

COMPOSITIONAL BALANCE

```
                                     WEIGHT OF
                   CARBON   HYDROGEN   NITROGEN   OXYGEN   SULFUR     ASH    WATER
FEED
 COAL               49.36       2.93       0.58    15.32     0.30   19.37    12.14
 RESIDUUM            6.18       0.69       0.06     0.01     0.34    0.00     0.00
 TOTAL IN           55.54       3.62       0.64    15.33     0.64   19.37    12.14
PRODUCTS
 PRODUCT            52.32       3.23       0.62    11.89     0.63   19.37     1.24
 WATER               0.00       0.00       0.00     0.00     0.00    0.00    12.10
 GAS                 0.00       0.00       0.00     0.00     0.00    0.00     0.00
 TOTAL OUT          52.32       3.23       0.62    11.89     0.63   19.37    13.34
 TOTAL OUT/IN        0.94       0.89       0.97     0.78     0.99    1.00     1.10
 UPGRADED COAL      56.24       3.10       0.69    14.48     0.36   23.62     1.51
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

```
                                 WM-26 (S1,T3,L2)

PRODUCT    WATER         GAS     RESIDUUM ON  RESIDUUM USED FOR    YIELD % OF
YIELD %   YIELD [illegible] %    PRODUCT %        FEED COAL %     UPGRADED COAL

  90.80    12.0[illegible]0.64       6.27             5.69              85.11

WT IN = 105.69

WT OUT= 103.44

MASS RECOVERY % =  97.87
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT     GAS         PRODUCT      UPGRADED COAL
   8463      17473       9775     32000        104.88             93.12

TOTAL BTU IN =525432

TOTAL BTU OUT=506849


BTU RECOVERY %= 96.46

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                      (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                          108.43                 96.27
```

COMPOSITIONAL BALANCE

```
                                     WEIGHT OF
                  CARBON  HYDROGEN  NITROGEN   OXYGEN   SULFUR    ASH    WATER
FEED
 COAL              51.51      2.89      0.66    13.93     0.30   18.48   12.23
 RESIDUUM           4.84      0.54      0.05     0.01     0.26    0.00    0.00
 TOTAL IN          56.35      3.43      0.71    13.94     0.56   18.48   12.23
PRODUCTS
 PRODUCT           53.90      3.56      0.63    12.41     0.59   18.48    1.23
 WATER              0.00      0.00      0.00     0.00     0.00    0.00   12.00
 GAS                0.00      0.00      0.00     0.00     0.00    0.00    0.00
 TOTAL OUT         53.90      3.56      0.63    12.41     0.59   18.48   13.23
 TOTAL OUT/IN       0.96      1.04      0.89     0.89     1.05    1.00    1.08
 UPGRADED COAL     57.65      3.55      0.68    14.58     0.38   21.71    1.44
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

WE-1 (S1,T1,L2)

PRODUCT YIELD %	WATER YIELD %	[illegible]	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
91.90	11.90	0.64	6.80	6.25	85.65

T IN = 106.25

WT OUT= 104.44

MASS RECOVERY % = 98.30

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
8463	17842	9702	32000	105.35	92.18

TOTAL BTU IN =532110

TOTAL BTU OUT=509096

BTU RECOVERY %= 95.67

NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
107.77	94.29

COMPOSITIONAL BALANCE

	WEIGHT OF CARBON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	51.51	2.89	0.66	13.93	0.30	18.48	12.23
RESIDUUM	5.48	0.52	0.06	0.06	0.13	0.00	0.00
TOTAL IN	56.99	3.41	0.72	13.99	0.43	18.48	12.23
PRODUCTS							
PRODUCT	57.88	3.44	0.57	10.78	0.46	18.48	0.28
WATER	0.00	0.00	0.00	0.00	0.00	0.00	11.90
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	57.88	3.44	0.57	10.78	0.46	18.48	12.18
TOTAL OUT/IN	1.02	1.01	0.80	0.77	1.08	1.00	1.00
UPGRADED COAL PERCENT	61.18	3.40	0.60	12.52	0.39	21.58	0.33

HE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

MASS BALANCE

WE-2 (S2,T1,L2)

PRODUCT YIELD %	WATER YIELD %	[illegible] Y[illegible] %	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
93.20	11.80	0.64	7.60	7.08	86.12

WT IN = 107.08

WT OUT= 105.64

MASS RECOVERY % = 98.65

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
8273	17842	8965	32000	101.00	85.72

TOTAL BTU IN =529821

TOTAL BTU OUT=477943

BTU RECOVERY %= 90.21

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
109.40	92.85

COMPOSITIONAL BALANCE

	WEIGHT OF						
	CARBON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	49.36	2.93	0.58	15.32	0.30	19.37	12.14
RESIDUUM	6.21	0.59	0.06	0.07	0.15	0.00	0.00
TOTAL IN	55.57	3.52	0.64	15.39	0.45	19.37	12.14
PRODUCTS							
PRODUCT	55.28	3.54	0.67	13.34	0.49	19.37	0.50
WATER	0.00	0.00	0.00	0.00	0.00	0.00	11.80
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	55.28	3.54	0.67	13.34	0.49	19.37	12.30
TOTAL OUT/IN	0.99	1.01	1.04	0.87	1.11	1.00	1.01
UPGRADED COAL PERCENT	56.99	3.42	0.70	15.40	0.41	22.49	0.59

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

MASS BALANCE

WE-3 (S3,T1,L2)

```
PRODUCT   WATER    [redacted]   RESIDUUM ON   RESIDUUM USED FOR    YIELD % OF
YIELD %   YIELD %                PRODUCT %       FEED COAL %       UPGRADED COAL

 100.20    11.60                   15.32            15.35               84.85

WT IN = 115.35

WT OUT= 112.44

MASS RECOVERY % =  97.48
```

BTU RECOVERIES

```
BTU/IB OF   BTU/IB OF   BTU/IB OF   BTU/IB OF   % BTU RECOVERY   % BTU RECOVERY
  COAL      RESIDUUM     PRODUCT       GAS          PRODUCT       UPGRADED COAL
   7939       17842        9784       32000         123.49            88.99

TOTAL BTU IN =593215

TOTAL BTU OUT=558398

BTU RECOVERY %= 94.13

NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                  (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                      127.58                  91.94
```

COMPOSITIONAL BALANCE

```
                                 WEIGHT OF
                 CARBON   HYDROGEN   NITROGEN   OXYGEN   SULFUR    ASH    WATER
FEED
 COAL             46.30      2.29       0.50     16.93     0.32   21.99   11.67
 RESIDUUM         13.46      1.29       0.14      0.15     0.31    0.00    0.00
 TOTAL IN         59.76      3.58       0.64     17.08     0.63   21.99   11.67
PRODUCTS
 PRODUCT          58.47      4.33       0.69     13.02     0.66   21.99    1.04
 WATER             0.00      0.00       0.00      0.00     0.00    0.00   11.60
 GAS               0.00      0.00       0.00      0.00     0.00    0.00    0.00
 TOTAL OUT        58.47      4.33       0.69     13.02     0.66   21.99   12.64
 TOTAL OUT/IN      0.98      1.21       1.09      0.76     1.04    1.00    1.08
 UPGRADED COAL    53.05      3.58       0.66     15.17     0.41   25.92    1.22
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

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                         MASS  BALANCE

                         WE-10 (S1,T2,L2)

 PRODUCT   WATER   [illegible]  RESIDUUM ON   RESIDUUM USED FOR   YIELD % OF
 YIELD %   YIELD %              PRODUCT %       FEED COAL %      UPGRADED COAL

  94.20     11.90  [illegible]     8.47            7.98              86.22

 WT IN = 107.98

 WT OUT= 106.74

 MASS RECOVERY % =  98.85


                         BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
  8463      17842       9905       32000        110.25           93.43

TOTAL BTU IN =549254

TOTAL BTU OUT=532117


BTU RECOVERY %= 96.88

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                 (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                      111.70                94.66


                  COMPOSITIONAL  BALANCE

                                 WEIGHT OF
                 CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL             51.51      2.89      0.66   13.93    0.30  18.48   12.23
 RESIDUUM          6.99      0.67      0.07    0.08    0.16   0.00    0.00
 TOTAL IN         58.50      3.56      0.73   14.01    0.46  18.48   12.23
PRODUCTS
 PRODUCT          57.69      3.69      0.62   13.09    0.43  18.48    0.19
 WATER             0.00      0.00      0.00    0.00    0.00   0.00   11.90
 GAS               0.00      0.00      0.00    0.00    0.00   0.00    0.00
 TOTAL OUT        57.69      3.69      0.62   13.09    0.43  18.48   12.09
 TOTAL OUT/IN      0.99      1.04      0.85    0.93    0.93   1.00    0.99
 UPGRADED COAL    58.80      3.51      0.64   15.09    0.31  21.43    0.22
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                      MASS  BALANCE

                          WE-11 (S2,T2,L2)

PRODUCT   WATER     GAS     RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %  YIELD %   PRODUCT %      FEED COAL %     UPGRADED COAL

 95.50    12.10     0.64     12.30           11.75              83.75

WT IN = 111.75

WT OUT= 108.24

MASS RECOVERY % =  96.86



                      BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM   PRODUCT      GAS        PRODUCT       UPGRADED COAL
   8273      17842     10098      32000       116.57            91.23

TOTAL BTU IN =576045

TOTAL BTU OUT=549510

BTU RECOVERY %= 95.39

NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                 (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                     115.33                 90.27



                 COMPOSITIONAL  BALANCE

                             WEIGHT OF
                CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL            49.36     2.93      0.58    15.32    0.30   19.37   12.14
 RESIDUUM        10.30     0.99      0.10     0.12    0.24    0.00    0.00
 TOTAL IN        59.66     3.92      0.68    15.44    0.54   19.37   12.14
PRODUCTS
 PRODUCT         57.99     3.81      0.69    12.53    0.45   19.37    0.66
 WATER            0.00     0.00      0.00     0.00    0.00    0.00   12.10
 GAS              0.00     0.00      0.00     0.00    0.00    0.00    0.00
 TOTAL OUT       57.99     3.81      0.69    12.53    0.45   19.37   12.76
 TOTAL OUT/IN     0.97     0.97      1.01     0.81    0.84    1.00    1.05
 UPGRADED COAL   56.94     3.37      0.70    14.82    0.25   23.13    0.79
 PERCENT

HE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                          MASS   BALANCE

                          WE-12 (S3,T2,L2)

PRODUCT    WATER      GAS          RESIDUUM ON   RESIDUUM USED FOR    YIELD % OF
YIELD %   YIELD %   [illegible]     PRODUCT %      FEED COAL %       UPGRADED COAL

 106.20    11.80    [illegible]      15.80           16.78              89.42

WT IN = 116.78

WT OUT= 118.64

MASS RECOVERY % = 101.59



                          BTU   RECOVERIES

BTU/IB OF   BTU/IB OF   BTU/IB OF   BTU/IB OF   % BTU RECOVERY   % BTU RECOVERY
  COAL      RESIDUUM     PRODUCT       GAS         PRODUCT       UPGRADED COAL
   7939       17842        9857       32000         131.86           94.15

TOTAL BTU IN =607379

TOTAL BTU OUT=595318


BTU RECOVERY %= 98.01


*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                    (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                         140.72                 100.47



                     COMPOSITIONAL   BALANCE

                                  WEIGHT OF
                 CARBON   HYDROGEN   NITROGEN   OXYGEN   SULFUR    ASH    WATER
FEED
 COAL             46.30      2.29       0.50     16.93     0.32   21.99   11.67
 RESIDUUM         14.71      1.41       0.15      0.17     0.34    0.00    0.00
 TOTAL IN         61.01      3.70       0.65     17.10     0.66   21.99   11.67
PRODUCTS
 PRODUCT          65.57      5.01       0.69     10.93     0.77   21.99    1.25
 WATER             0.00      0.00       0.00      0.00     0.00    0.00   11.80
 GAS               0.00      0.00       0.00      0.00     0.00    0.00    0.00
 TOTAL OUT        65.57      5.01       0.69     10.93     0.77   21.99   13.05
 TOTAL OUT/IN      1.07      1.35       1.06      0.64     1.16    1.00    1.12
 UPGRADED COAL    56.87      4.03       0.61     12.03     0.48   24.59    1.39
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

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                           MASS BALANCE

                         WE-17 (S1,T3,L2)

RODUCT   WATER    [illegible]    RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %              - PRODUCT %      FEED COAL %     UPGRADED COAL

 91.60    11.80     0.64        8.27            7.58              84.02

T IN = 107.58

WT OUT= 104.04

ASS RECOVERY % =  96.71



                         BTU RECOVERIES

TU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
 COAL     RESIDUUM    PRODUCT      GAS        PRODUCT       UPGRADED COAL
 8463      17842       8918       32000        96.52            80.55

TOTAL BTU IN =545255

OTAL BTU OUT=467582

TU RECOVERY %= 85.75

NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                   (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                       106.91                89.22



                   COMPOSITIONAL BALANCE

                               WEIGHT OF
                CARBON   HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
EED
 COAL            51.51      2.89      0.66    13.93    0.30   18.48   12.23
 RESIDUUM         6.64      0.64      0.07     0.08    0.16    0.00    0.00
 TOTAL IN        58.15      3.53      0.73    14.01    0.46   18.48   12.23
RODUCTS
 PRODUCT         55.98      3.62      0.60    11.70    0.41   18.48    0.81
 WATER            0.00      0.00      0.00     0.00    0.00    0.00   11.80
 GAS              0.00      0.00      0.00     0.00    0.00    0.00    0.00
 TOTAL OUT       55.98      3.62      0.60    11.70    0.41   18.48   12.61
 TOTAL OUT/IN     0.96      1.03      0.82     0.84    0.89    1.00    1.03
 UPGRADED COAL   58.72      3.55      0.63    13.83    0.30   21.99    0.97
PERCENT

HE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

WE-18 (S2,T3,L2)

PRODUCT YIELD %	WATER YIELD %	GAS	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
94.00	11.90	[illegible]	11.20	10.53	83.47

WT IN = 110.53

WT OUT= 106.54

MASS RECOVERY % = 96.39

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
8273	17842	10163	32000	115.47	92.77

TOTAL BTU IN =563967

TOTAL BTU OUT=544489

BTU RECOVERY %= 96.55

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
113.75	91.38

COMPOSITIONAL BALANCE

WEIGHT OF

	CARBON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	49.36	2.93	0.58	15.32	0.30	19.37	12.14
RESIDUUM	9.23	0.88	0.09	0.11	0.22	0.00	0.00
TOTAL IN	58.59	3.81	0.67	15.43	0.52	19.37	12.14
PRODUCTS							
PRODUCT	55.74	3.44	0.66	13.57	0.47	19.37	0.74
WATER	0.00	0.00	0.00	0.00	0.00	0.00	11.90
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	55.74	3.44	0.66	13.57	0.47	19.37	12.64
TOTAL OUT/IN	0.95	0.90	0.98	0.88	0.92	1.00	1.04
UPGRADED COAL PERCENT	55.72	3.07	0.68	16.14	0.31	23.21	0.89

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

MASS BALANCE

PD-5B (S3,T1,L2)

PRODUCT YIELD %	WATER YIELD %	GAS YIELD %	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
93.50	17.50	0.61	19.15	17.91	75.59

WT IN = 117.91

WT OUT= 111.64

MASS RECOVERY % = 94.69

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
6764	17316	9879	32000	136.56	90.72

TOTAL BTU IN =548026

TOTAL BTU OUT=526914

BTU RECOVERY %= 96.15

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
139.01	92.35

COMPOSITIONAL BALANCE

	WEIGHT OF CARBON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	44.96	2.31	0.55	13.39	0.73	20.29	17.77
RESIDUUM	15.12	1.45	0.19	0.03	1.12	0.00	0.00
TOTAL IN	60.08	3.76	0.74	13.42	1.85	20.29	17.77
PRODUCTS							
PRODUCT	55.32	3.62	0.60	11.93	1.65	20.29	0.10
WATER	0.00	0.00	0.00	0.00	0.00	0.00	17.50
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	55.32	3.62	0.60	11.93	1.65	20.29	17.60
TOTAL OUT/IN	0.92	0.96	0.81	0.89	0.89	1.00	0.99
UPGRADED COAL PERCENT	53.17	2.87	0.55	15.74	0.70	26.84	0.14

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

MASS BALANCE

```
                              PD-6C (S1,T1,L2)

PRODUCT    WATER       GAS     RESIDUUM ON  RESIDUUM USED FOR    YIELD % OF
YIELD %   YIELD %   YIELD %    PRODUCT %      FEED COAL %      UPGRADED COAL

 85.00     23.10      0.64      14.34           12.19              72.81

WT IN = 112.19

WT OUT= 108.74

MASS RECOVERY % =  96.93
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
  7079       17316      10688      32000       128.33           98.52

TOTAL BTU IN =510536

TOTAL BTU OUT=518466

BTU RECOVERY %=101.55

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

                 (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                     123.13                 94.52
```

COMPOSITIONAL BALANCE

```
                                       WEIGHT OF
                   CARBON   HYDROGEN   NITROGEN   OXYGEN   SULFUR    ASH    WATER
FEED
 COAL              44.86       2.16       0.47    15.32     0.55   15.55    21.09
 RESIDUUM          10.30       0.98       0.13     0.02     0.76    0.00     0.00
 TOTAL IN          55.16       3.14       0.60    15.34     1.31   15.55    21.09
PRODUCTS
 PRODUCT           52.05       3.33       0.65    11.88     1.26   15.55     0.27
 WATER              0.00       0.00       0.00     0.00     0.00    0.00    23.10
 GAS                0.00       0.00       0.00     0.00     0.00    0.00     0.00
 TOTAL OUT         52.05       3.33       0.65    11.88     1.26   15.55    23.37
 TOTAL OUT/IN       0.94       1.06       1.09     0.77     0.96    1.00     1.11
 UPGRADED COAL     57.35       3.22       0.72    16.29     0.69   21.36     0.37
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

```
                                PD-9 (S2.T1,L2)

PRODUCT   WATER       GAS     RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %   YIELD %    PRODUCT %       FEED COAL %     UPGRADED COAL

  87.70    18.20      0.64      13.76            12.07             75.63

WT IN = 112.07

WT OUT= 106.54

MASS RECOVERY % =  95.07
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
   7029      17316       9763      32000       121.81            92.08

TOTAL BTU IN =506590

TOTAL BTU OUT=489430


BTU RECOVERY %= 96.61

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                    (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                        126.76                  95.82
```

COMPOSITIONAL BALANCE

```
                                  WEIGHT OF
                    CARBON  HYDROGEN  NITROGEN  OXYCEN  SULFUR    ASH   WATER
FEED
 COAL                43.97     3.43      0.51    15.69    0.65  17.30   19.45
 RESIDUUM            10.19     0.98      0.13     0.02    0.75   0.00    0.00
 TOTAL IN            54.16     3.41      0.64    15.71    1.40  17.30   19.45
PRODUCTS
 PRODUCT             51.86     3.37      0.60    12.92    1.29  17.30    0.37
 WATER                0.00     0.00      0.00     0.00    0.00   0.00   18.20
 GAS                  0.00     0.00      0.00     0.00    0.00   0.00    0.00
 TOTAL OUT           51.86     3.37      0.60    12.92    1.29  17.30   18.57
 TOTAL OUT/IN         0.96     0.99      0.95     0.82    0.92   1.00    0.95
 UPGRADED COAL       55.08     3.16      0.63    17.06    0.71  22.87    0.48
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

```
                          PD-14 (S2,T2,L2)

PRODUCT   WATER     GAS    RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %  YIELD %   PRODUCT %      FEED COAL %     UPGRADED COAL

 88.30    18.30    0.64      17.50           15.45              72.85

WT IN = 115.45

WT OUT= 107.24

MASS RECOVERY % =  92.89
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT       UPGRADED COAL
   7029      17316      10302      32000       129.42            91.35

TOTAL BTU IN =539153

TOTAL BTU OUT=519125

BTU RECOVERY %= 96.29

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

                (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                   126.04                 88.97
```

COMPOSITIONAL BALANCE

```
                                   WEIGHT OF
                 CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR   ASH    WATER
FEED
 COAL             43.97     2.43      0.51    15.69    0.65   17.30   19.45
 RESIDUUM         13.05     1.25      0.16     0.03    0.96    0.00    0.00
 TOTAL IN         57.02     3.68      0.67    15.72    1.61   17.30   19.45
PRODUCTS
 PRODUCT          52.22     3.67      0.64    12.25    1.63   17.30    0.58
 WATER             0.00     0.00      0.00     0.00    0.00    0.00   18.30
 GAS               0.00     0.00      0.00     0.00    0.00    0.00    0.00
 TOTAL OUT        52.22     3.67      0.64    12.25    1.63   17.30   18.88
 TOTAL OUT/IN      0.92     1.00      0.96     0.78    1.01    1.00    0.97
 UPGRADED COAL    53.76     3.33      0.66    16.77    0.92   23.75    0.80
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                              MASS BALANCE

                            PD-17 (S1,T2,L2)

PRODUCT   WATER      GAS       RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %   YIELD [illegible] [illegible] %   PRODUCT %     FEED COAL %      UPGRADED COAL

 84.70    21.0[illegible]  0.64      14.38          12.18                72.52

WT IN = 112.18

WT OUT= 106.34

MASS RECOVERY % =  94.79



                              BTU RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM   PRODUCT      GAS         PRODUCT      UPGRADED COAL
   7079      17316      9857      32000        117.94           88.15

TOTAL BTU IN =510448

TOTAL BTU OUT=477582


BTU RECOVERY %= 93.56

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                  (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                      121.65                  90.92



                         COMPOSITIONAL BALANCE

                                   WEIGHT OF
                 CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL             44.86      2.16      0.47   15.32    0.55  15.55   21.09
 RESIDUUM         10.29      0.98      0.13    0.02    0.76   0.00    0.00
 TOTAL IN         55.15      3.14      0.60   15.34    1.31  15.55   21.09
PRODUCTS
 PRODUCT          50.20      3.51      0.63   12.89    1.48  15.55    0.45
 WATER             0.00      0.00      0.00    0.00    0.00   0.00   21.00
 GAS               0.00      0.00      0.00    0.00    0.00   0.00    0.00
 TOTAL OUT        50.20      3.51      0.63   12.89    1.48  15.55   21.45
 TOTAL OUT/IN      0.91      1.12      1.05    0.84    1.13   1.00    1.02
 UPGRADED COAL    55.04      3.49      0.69   17.74    0.99  21.44    0.61
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                         MASS BALANCE

                       PD-20 (S1,T3,L3)

PRODUCT    WATER      GAS     RESIDUUM ON   RESIDUUM USED FOR    YIELD % OF
YIELD %   YIELD %   YIELD %    PRODUCT %      FEED COAL %      UPGRADED COAL

 88.40     21.20      0.64       14.85           13.13              75.27

WT IN = 113.13

WT OUT= 110.24

MASS RECOVERY % =  97.45



                       BTU RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
  7079       17316      10508      32000       131.22           99.11

TOTAL BTU IN =519563

TOTAL BTU OUT=529814


BTU RECOVERY %=101.97

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

                 (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                     130.77                 98.77



                   COMPOSITIONAL BALANCE

                                WEIGHT OF
                CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL            44.86     2.16      0.47    15.32    0.55  15.55   21.09
 RESIDUUM        11.09     1.06      0.14     0.02    0.82   0.00    0.00
 TOTAL IN        55.95     3.22      0.61    15.34    1.37  15.55   21.09
PRODUCTS
 PRODUCT         54.02     3.61      0.69    11.96    1.34  15.55    1.23
 WATER            0.00     0.00      0.00     0.00    0.00   0.00   21.20
 GAS              0.00     0.00      0.00     0.00    0.00   0.00    0.00
 TOTAL OUT       54.02     3.61      0.69    11.96    1.34  15.55   22.43
 TOTAL OUT/IN     0.97     1.12      1.13     0.78    0.98   1.00    1.06
 UPGRADED COAL   57.04     3.39      0.73    15.85    0.69  20.66    1.64
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                         MASS  BALANCE

                       PD-18 (S3,T2,L2)

PRODUCT   WATER          GAS    RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD[illegible]LD %   PRODUCT %       FEED COAL %     UPGRADED COAL

 96.90    16.9[illegible]0.64     22.08           21.40              75.50

WT IN = 121.40

WT OUT= 114.44

MASS RECOVERY % =  94.27



                       BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT     GAS         PRODUCT      UPGRADED COAL
  6764       17316      10011     32000        143.42           98.64

TOTAL BTU IN =581603

TOTAL BTU OUT=552680

BTU RECOVERY %= 95.03

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                    146.08                90.29



                    COMPOSITIONAL  BALANCE

                          WEIGHT OF
               CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL           44.96      2.31      0.55   13.39    0.73   20.29   17.77
 RESIDUUM       18.07      1.73      0.22    0.04    1.34    0.00    0.00
 TOTAL IN       63.03      4.04      0.77   13.43    2.07   20.29   17.77
PRODUCTS
 PRODUCT        57.12      3.98      0.72   11.91    2.20   20.29    0.68
 WATER           0.00      0.00      0.00    0.00    0.00    0.00   16.90
 GAS             0.00      0.00      0.00    0.00    0.00    0.00    0.00
 TOTAL OUT      57.12      3.99      0.72   11.91    2.20   20.29   17.58
 TOTAL OUT/IN    0.91      0.98      0.93    0.89    1.07    1.00    0.99
 UPGRADED COAL  51.71      2.98      0.66   15.73    1.15   26.87    0.90
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

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                              PD-22 (S2,T3,L3)

 PRODUCT   WATER          GAS      RESIDUUM ON  RESIDUUM USED FOR     YIELD % OF
 YIELD %  YIELD [illegible]ELD %  PRODUCT %       FEED COAL %      UPGRADED COAL

  91.00     18.5[illegible]  0.64      19.27            17.54               73.46

 WT IN = 117.54

 WT OUT= 110.14

 MASS RECOVERY % =  93.71
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM   PRODUCT      GAS         PRODUCT      UPGRADED COAL
   7029      17316     10111      32000        130.90           87.70

TOTAL BTU IN =559193

TOTAL BTU OUT=524922

BTU RECOVERY %= 93.87

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

                   (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                       135.31                   90.66
```

COMPOSITIONAL BALANCE

```
                                  WEIGHT OF
                 CARBON   HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH    WATER
FEED
 COAL
 RESIDUUM         43.97     2.43      0.51    15.69    0.65    17.30   19.45
 TOTAL IN         14.81     1.42      0.18     0.03    1.09     0.00    0.00
PRODUCTS          58.78     3.85      0.69    15.72    1.74    17.30   19.45
 PRODUCT
 WATER            54.80     3.68      0.68    11.37    1.91    17.30    1.26
 GAS               0.00     0.00      0.00     0.00    0.00     0.00   18.50
 TOTAL OUT         0.00     0.00      0.00     0.00    0.00     0.00    0.00
 TOTAL OUT/IN     54.80     3.68      0.68    11.37    1.91    17.30   19.76
 UPGRADED COAL     0.93     0.96      0.98     0.72    1.09     1.00    1.02
 PERCENT          54.43     3.08      0.67    15.44    1.11    23.55    1.72

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                              MASS  BALANCE

                               PD-24 (S3,T3,L3)

PRODUCT   WATER      GAS     RESIDUUM ON   RESIDUUM USED FOR    YIELD % OF
YIELD %  YIELD %  YIELD %     PRODUCT %       FEED COAL %     UPGRADED COAL

  95.70    17.00     0.64       19.28            18.45              77.25

WT IN = 118.45

WT OUT= 113.34

MASS RECOVERY % =  95.69


                           BTU  RECOVERIES

BTU/IB OF   BTU/IB OF   BTU/IB OF   BTU/IB OF   % BTU RECOVERY   % BTU RECOVERY
  COAL      RESIDUUM     PRODUCT       GAS          PRODUCT      UPGRADED COAL
   6764       17316        9754       32000         138.00            90.77

TOTAL BTU IN =553276

TOTAL BTU OUT=532343

BTU RECOVERY %= 96.22

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                  (BTU-RE-PRODUCT)       (BTU-RE-UPG. COAL)

                      143.56                   94.42


                    COMPOSITIONAL  BALANCE

                                    WEIGHT OF
                  CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH    WATER
FEED
 COAL              44.96    2.31      0.55    13.39    0.73    20.29   17.77
 RESIDUUM          15.59    1.49      0.19     0.03    1.15     0.00    0.00
 TOTAL IN          60.55    3.80      0.74    13.42    1.88    20.29   17.77
PRODUCTS
 PRODUCT           56.70    3.82      0.70    11.06    1.87    20.29    1.25
 WATER              0.00    0.00      0.00     0.00    0.00     0.00   17.00
 GAS                0.00    0.00      0.00     0.00    0.00     0.00    0.00
 TOTAL OUT         56.70    3.82      0.70    11.06    1.87    20.29   18.25
 TOTAL OUT/IN       0.94    1.01      0.94     0.82    0.99     1.00    1.03
 UPGRADED COAL     53.23    3.02      0.65    14.28    0.93    26.27    1.62
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                        MASS  BALANCE

                       PM-2 (S2,T1,L2)

PRODUCT   WATER     GAS    RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %  YIELD %   PRODUCT %      FEED COAL %     UPGRADED COAL

 34.20    18.90     0.64     14.40           12.12              72.08

WT IN = 112.12

WT OUT= 103.74

MASS RECOVERY % =  92.53



                      BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
   7029      17473      10259      32000        122.89           92.78

TOTAL BTU IN =508198

TOTAL BTU OUT=493648


BTU RECOVERY %= 97.14

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                  (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                      118.89                 89.73



                  COMPOSITIONAL  BALANCE

                                WEIGHT OF
                CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL            43.97      2.43      0.51   15.69    0.65  17.30   19.45
 RESIDUUM        10.30      1.15      0.10    0.01    0.56   0.00    0.00
 TOTAL IN        54.27      3.58      0.61   15.70    1.21  17.30   19.45
PRODUCTS
 PRODUCT         48.86      3.31      0.63   11.72    1.03  17.30    1.36
 WATER            0.00      0.00      0.00    0.00    0.00   0.00   18.90
 GAS              0.00      0.00      0.00    0.00    0.00   0.00    0.00
 TOTAL OUT       48.86      3.31      0.63   11.72    1.03  17.30   20.26
 TOTAL OUT/IN     0.90      0.92      1.03    0.75    0.85   1.00    1.04
 UPGRADED COAL   53.49      2.99      0.73   16.25    0.64  24.00    1.89
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

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                                 PM-3 (S3,T1,L2)

PRODUCT   WATER     GAS     RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %  YIELD %    PRODUCT %      FEED COAL %     UPGRADED COAL

  91.10    17.20    0.64      15.80           14.39             76.71

WT IN = 114.39

WT OUT= 108.94

MASS RECOVERY % =  95.23
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS         PRODUCT      UPGRADED COAL
   5764      17473        9966     32000        134.23           97.04

TOTAL BTU IN =515502

TOTAL BTU OUT=518145

BTU RECOVERY %=100.51

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

                 (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                      134.36                97.14
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COMPOSITIONAL BALANCE

```
                                     WEIGHT OF
                    CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL               44.96       2.31      0.55   13.39    0.73  20.29   17.77
 RESIDUUM           12.23       1.36      0.12    0.01    0.67   0.00    0.00
 TOTAL IN           57.19       3.67      0.67   13.40    1.40  20.29   17.77
PRODUCTS
 PRODUCT            52.66       3.64      0.66   11.29    1.33  20.29    1.23
 WATER               0.00       0.00      0.00    0.00    0.00   0.00   17.20
 GAS                 0.00       0.00      0.00    0.00    0.00   0.00    0.00
 TOTAL OUT          52.66       3.64      0.66   11.29    1.33  20.29   18.43
 TOTAL OUT/IN        0.92       0.99      0.98    0.84    0.95   1.00    1.04
 UPGRADED COAL      52.71       2.96      0.70   14.70    0.86  26.45    1.60
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

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                         PM-10 (S1,T2,L2)

PRODUCT   WATER     GAS     RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %  YIELD %   PRODUCT %      FEED COAL %     UPGRADED COAL

 89.70    20.60    0.64      10.90            9.78              79.93

WT IN = 109.78

WT OUT= 110.94

MASS RECOVERY % = 101.06
```

BTU RECOVERIES

```
BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
   7079      17473       9610      32000       121.77            97.64

TOTAL BTU IN =498188

TOTAL BTU OUT=492653

BTU RECOVERY %=100.91

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

               (BTU-RE-PRODUCT)     (BTU-RE-UPG. COAL)

                   127.27                102.05
```

COMPOSITIONAL BALANCE

```
                                 WEIGHT OF
               CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL           44.86      2.16      0.47   15.32    0.55  15.55   21.09
 RESIDUUM        8.31      0.93      0.08    0.01    0.45   0.00    0.00
 TOTAL IN       53.17      3.09      0.55   15.33    1.00  15.55   21.09
PRODUCTS
 PRODUCT        53.21      3.86      0.62   13.68    1.00  15.55    1.78
 WATER           0.00      0.00      0.00    0.00    0.00   0.00   20.60
 GAS             0.00      0.00      0.00    0.00    0.00   0.00    0.00
 TOTAL OUT      53.21      3.86      0.62   13.69    1.00  15.55   22.38
 TOTAL OUT/IN    1.00      1.25      1.12    0.89    1.00   1.00    1.06
 UPGRADED COAL  56.18      3.67      0.67   17.10    0.69  19.46    2.23
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                              MASS  BALANCE

                              PM-11 (S2,T2,L2)

PRODUCT   WATER      GAS    RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %  YIELD %   PRODUCT %       FEED COAL %     UPGRADED COAL

 95.70    18.90     0.64     16.70             15.98             79.72

WT IN = 115.98

WT OUT= 115.24

MASS RECOVERY % =  99.36


                              BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS         PRODUCT     UPGRADED COAL
  7029      17473       9750       32000        132.75           93.02

TOTAL BTU IN =545640

TOTAL BTU OUT=532130

BTU RECOVERY %= 97.52

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

                    (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                        138.50                  97.05


                          COMPOSITIONAL  BALANCE

                               WEIGHT OF
                  CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR   ASH   WATER
FEED
 COAL              43.97    2.43      0.51    15.69    0.65   17.30  19.45
 RESIDUUM          13.58    1.52      0.13     0.01    0.74    0.00   0.00
 TOTAL IN          57.55    3.95      0.64    15.70    1.39   17.30  19.45
PRODUCTS
 PRODUCT           55.42    3.67      0.71    15.22    1.28   17.30   2.11
 WATER              0.00    0.00      0.00     0.00    0.00    0.00  18.90
 GAS                0.00    0.00      0.00     0.00    0.00    0.00   0.00
 TOTAL OUT         55.42    3.67      0.71    15.22    1.28   17.30  21.01
 TOTAL OUT/IN       0.96    0.93      1.11     0.97    0.92    1.00   1.08
 UPGRADED COAL     52.48    2.71      0.72    19.07    0.67   21.70   2.64
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
```

MASS BALANCE

PM-12 (S3,T2,L2)

PRODUCT YIELD %	WATER YIELD %	GAS YIELD %	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
99.60	16.5[illegible]	0.64	21.50	21.41	78.19

WT IN = 121.41

WT OUT= 116.74

MASS RECOVERY % = 96.15

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
6764	17473	9970	32000	146.81	91.49

TOTAL BTU IN =583648

TOTAL BTU OUT=565428

BTU RECOVERY %= 96.88

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
149.70	93.29

COMPOSITIONAL BALANCE

	WEIGHT OF CARBON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	44.96	2.31	0.55	13.39	0.73	20.29	17.77
RESIDUUM	18.19	2.03	0.18	0.02	1.00	0.00	0.00
TOTAL IN	63.15	4.34	0.73	13.41	1.73	20.29	17.77
PRODUCTS							
PRODUCT	58.33	4.07	0.74	13.13	1.53	20.29	1.50
WATER	0.00	0.00	0.00	0.00	0.00	0.00	16.50
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	58.33	4.07	0.74	13.13	1.53	20.29	18.00
TOTAL OUT/IN	0.92	0.94	1.02	0.98	0.89	1.00	1.01
UPGRADED COAL PERCENT	51.33	2.61	0.72	16.77	0.69	25.95	1.93

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

MASS BALANCE

PM-19 (S1,T3,L2)

PRODUCT YIELD %	WATER YIELD %	GAS YIELD %	RESIDUUM ON PRODUCT %	RESIDUUM USED FOR FEED COAL %	YIELD % OF UPGRADED COAL
89.30	20.8[illegible]	0.64	10.38	9.27	80.03

WT IN = 109.27

WT OUT= 110.74

MASS RECOVERY % = 101.35

BTU RECOVERIES

BTU/IB OF COAL	BTU/IB OF RESIDUUM	BTU/IB OF PRODUCT	BTU/IB OF GAS	% BTU RECOVERY PRODUCT	% BTU RECOVERY UPGRADED COAL
7079	17473	9868	32000	124.48	101.60

TOTAL BTU IN =483257

TOTAL BTU OUT=503317

BTU RECOVERY %=104.15

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

(BTU-RE-PRODUCT)	(BTU-RE-UPG. COAL)
132.33	108.01

COMPOSITIONAL BALANCE

	WEIGHT OF CARBON	HYDROGEN	NITROGEN	OXYGEN	SULFUR	ASH	WATER
FEED							
COAL	44.86	2.16	0.47	15.32	0.55	15.55	21.09
RESIDUUM	7.88	0.88	0.08	0.01	0.43	0.00	0.00
TOTAL IN	52.74	3.04	0.55	15.33	0.98	15.55	21.09
PRODUCTS							
PRODUCT	54.54	3.61	0.74	12.50	1.26	15.55	1.10
WATER	0.00	0.00	0.00	0.00	0.00	0.00	20.80
GAS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL OUT	54.54	3.61	0.74	12.50	1.26	15.55	21.90
TOTAL OUT/IN	1.03	1.19	1.36	0.82	1.29	1.00	1.04
UPGRADED COAL PERCENT	58.30	3.41	0.83	15.61	1.04	19.43	1.38

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00

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                              MASS  BALANCE

                             PM-20 (S2,T3,L2)

PRODUCT   WATER      GAS    RESIDUUM ON  RESIDUUM USED FOR   YIELD % OF
YIELD %  YIELD %* YIELD %   PRODUCT %       FEED COAL %     UPGRADED COAL

 85.80    18.70*    0.64      13.80            11.84            73.96

WT IN = 111.84

WT OUT= 105.14

MASS RECOVERY % =  94.01



                           BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM    PRODUCT      GAS        PRODUCT      UPGRADED COAL
   7029      17473      10264      32000       125.29            95.85

TOTAL BTU  IN =505437

TOTAL BTU OUT=503006


BTU RECOVERY %= 99.52

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE:

                   (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                       125.72                 96.19



                     COMPOSITIONAL  BALANCE

                                 WEIGHT OF
                 CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH    WATER
FEED
 COAL             43.97      2.43      0.51   15.69    0.65   17.30   19.45
 RESIDUUM         10.06      1.12      0.10    0.01    0.55    0.00    0.00
 TOTAL IN         54.03      3.55      0.61   15.70    1.20   17.30   19.45
PRODUCTS
 PRODUCT          51.74      3.60      0.63   10.25    1.16   17.30    1.12
 WATER             0.00      0.00      0.00    0.00    0.00    0.00   18.70
 GAS               0.00      0.00      0.00    0.00    0.00    0.00    0.00
 TOTAL OUT        51.74      3.60      0.63   10.25    1.16   17.30   19.82
 TOTAL OUT/IN      0.96      1.01      1.04    0.65    0.97    1.00    1.02
 UPGRADED COAL    56.35      3.35      0.72   13.85    0.83   23.39    1.51
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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                              MASS  BALANCE

                            PM-21 (S3,T3,L2)

PRODUCT   WATER     GAS       RESIDUUM ON   RESIDUUM USED FOR    YIELD % OF
YIELD %   YIELD %   YIELD %    PRODUCT %       FEED COAL %      UPGRADED COAL

  93.10    16.70     0.64       18.70            17.41              75.69

WT IN = 117.41

WT OUT= 110.44

MASS RECOVERY % =  94.06


                            BTU  RECOVERIES

BTU/IB OF  BTU/IB OF  BTU/IB OF  BTU/IB OF  % BTU RECOVERY  % BTU RECOVERY
  COAL     RESIDUUM   PRODUCT      GAS         PRODUCT      UPGRADED COAL
  6764      17473      10217      32000        140.63            95.65

TOTAL BTU IN =544778

TOTAL BTU OUT=542201

BTU RECOVERY %= 99.53

*NOTE: BTU RECOVERIES AFTER ADJUSTMENT FOR ASH VARIATIONS DUE TO SAMPLING ARE

                (BTU-RE-PRODUCT)      (BTU-RE-UPG. COAL)

                     138.97                 94.53


                      COMPOSITIONAL  BALANCE

                                    WEIGHT OF
                   CARBON  HYDROGEN  NITROGEN  OXYGEN  SULFUR    ASH   WATER
FEED
 COAL               44.96      2.31      0.55   13.39    0.73  20.29   17.77
 RESIDUUM           14.79      1.65      0.14    0.02    0.81   0.00    0.00
 TOTAL IN           59.75      3.96      0.69   13.41    1.54  20.29   17.77
PRODUCTS
 PRODUCT            55.81      3.79      0.72    9.74    1.32  20.29    1.43
 WATER               0.00      0.00      0.00    0.00    0.00   0.00   16.70
 GAS                 0.00      0.00      0.00    0.00    0.00   0.00    0.00
 TOTAL OUT          55.81      3.79      0.72    9.74    1.32  20.29   18.13
 TOTAL OUT/IN        0.93      0.96      1.04    0.73    0.86   1.00    1.02
 UPGRADED COAL      54.19      2.83      0.76   12.85    0.68  26.81    1.88
 PERCENT

THE TOTAL OF THE UPGRADED COAL PERCENTS IS =100.00
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POOR

QUALITY

ORIGINAL